The New Communications Paradigm: Implications for Universal Service

by Steve G. Parsons, Ph.D.

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The New Communications Paradigm: Implications for Universal Service[1]

By Steve G. Parsons, Ph.D.[2]

I. Introduction

Universal Service concepts have a long but changing history. While the essence of virtually all universal service concepts is that customers (or citizens, potential customers) be interconnected to a communications network,[3] ideas regarding the method of connection have changed. Perhaps the first notion of universal telephone service in the United States was that advanced by the C.E.O. of AT&T, Theodore Vail, at the beginning

[1] This manuscript provides an update to a paper I wrote "A Paradigm Shift in Concepts of Universal Service" submitted on behalf of Western Wireless in Federal-State Joint Board on Universal Service proceeding at the FCC in Docket No. 96-45 on May 5, 2003. For completeness, some of the original language from the 2003 paper remains.

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[3] In my original paper of May 5, 2003, I used the phrase switched public telecommunications network (SPTN) instead of public switched telephone network (PSTN) to consider a broader concept of access. However, even SPTN is laden with old school language and is abandoned here.

of the twentieth century. Vail's notion of universal service was that the nation's inhabitants should be interconnected via the facilities of a single company – AT&T.[4]

Given the historical growth of landline telecommunications infrastructure, the concept of interconnecting citizens had the practical effect of placing landline infrastructure to interconnect locations where citizens spent most of their time: homes and businesses. However, this perception of interconnection and universal service has changed in at least two important aspects over time. First, universal service is no longer predicated on interconnection and telephone service via landline facilities. Second, the demand for connectivity occurs across time and space.

II. U.S. History Created a Bias In Favor of Wireline Technology

Historically (before the Telecommunications Act of 1996), only incumbent landline local exchange carriers were allowed to receive universal service funding. In rural areas, it appears that universal service funding and/or other forms of cross-subsidies (primarily switched access charges) represented (and still represents today in many instances) a significant proportion of rural ILEC overall revenues. In the early periods of infrastructure development, this may have been at least partially justified by the economics of the access (or network) externality.[5] However, after the commercial introduction of wireless communication, these programs created distorted incentives in production favoring wireline technologies and created a bias against wireless technologies.

As a general matter, wireless cost structures tend to be less sensitive to distance than wireline costs (at a given level of market share). Therefore, the cost minimizing technology choice in some longer distance (landline long-loop) areas would have been wireless, rather than wireline technology. As such, it is reasonable to expect that without wireline's historical momentum and without this historical distortion in incentives and inefficiency in production, many low-density rural areas would have been initially served

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[4] *See, e.g.,* STUART BENJAMIN, DOUGLAS LICHTMAN, & HOWARD SHELANSKI, TELECOMMUNICATIONS LAW AND POLICY 614-620 (1st ed. 2001); Gerald Brock, *Historical Overview, in* HANDBOOK OF TELECOMMUNICATIONS ECONOMICS: STRUCTURE, REGULATION, AND COMPETITION 50-52 (M. Cave, S. Mujamdar, and I. Vogelsand eds., 2002) .

[5] The demand for access to a network, unlike the demand for most products or services, critically depends on the number of other customers that are also connected to the network. This is similar to the concept of a direct network effect. *See, e.g.,* Stanly Liebowitz, & Stephen Margolis, *Network Effects,* in HANDBOOK OF TELECOMMUNICATIONS ECON.: STRUCTURE, REGULATION, AND COMPETITION 76 (Cave et. al. eds., 2002); Jeffrey Rohlfs, *A Theory of Interdependent Demand for a Communications Service* 5 BELL J. OF ECON. AND MGMT. SCI. 16 (1974); Jeffrey Rohlfs, *Bandwagon Effects in Telecommunications,* in HANDBOOK OF TELECOMMUNICATIONS ECON.: VOL. 2, 81 (S. K. Majumdar et al, eds, 2005); HAL VARIAN, JOSEPH FARRELL, & CARL SHAPIRO, THE ECONOMICS OF INFORMATION TECHNOLOGY, (Cambridge U. Press 2004); and JOHN WENDERS, THE ECONOMICS OF TELECOMMUNICATIONS 29 (Ballinger 1987).

by wireless technology. The Telecommunications Act of 1996 and the FCC's implementation of the Act was supposed to have (at least in theory) eliminated this source of technology bias and production inefficiency by allowing wireless providers to have access to universal service funding.

III. Universal Service Is No Longer Predicated on Network Connection Via Land-Line Facilities

Consider the measures of telephone subscribership in the United States. The key question in the underlying surveys seeking to quantify subscribership has been: "is there a telephone in this house/apartment?"[6] Before the 1990s, this question was likely designed and interpreted to refer to landline telephones. Indeed, in the FCC's Subscribership Reports, the word "wireless" or "mobile" does not exist regarding survey questions in reports released through February 2002.[7] Through November 2004, the relevant question had been: "Is there a telephone in this house/apartment?"[8] Because of the increasing number of households that have wireless only, there was some concern that some of these households may not consider their cell phones as a telephone. Consequently, beginning in December 2004, CPS [current population survey] changed its telephone question to ""Does this house, apartment, or mobile home have telephone service from which you can both make and receive calls? Please include cell phones, regular phones, and any other type of telephone."[9] Therefore, current measures of subscribership are intended to include wireless telephone service.

IV. The Demand for Connectivity Across Time and Space[10]

[6] *See* FCC, TELEPHONE SUBSCRIBERSHIP IN THE UNITED STATES (January, 1997) *available at* (http://www.fcc.gov/Bureaus/Common_Carrier/Reports/FCC-State_Link/IAD/subs1196.pdf).

[7] *See* FCC, TELEPHONE SUBSCRIBERSHIP IN THE UNITED STATES (February, 2002) *available at* (http://www.fcc.gov/Bureaus/Common_Carrier/Reports/FCC-State_Link/IAD/subs0701.pdf).

[8] FCC, DECEMBER 2006 MONITORING REPORT, fn 4, *available at* (http://www.fcc.gov/wcb/iatd/monitor.html).

[9] FCC, DECEMBER 2006 MONITORING REPORT, fn 4, *available at* (http://www.fcc.gov/wcb/iatd/monitor.html).

[10] "Connectivity" here is used broadly to refer to any form of demand for access to communications-like networks (voice or data) and it is not intended to imply only access to the Internet. In my 2003 paper, I used counter acronym Switched Public Telephone Network (SPTN) to try to force the reader to think about connectivity differently from the PSTN; however, SPTN is also exceptionally old school in vernacular.

The second fundamental change in the concept of universal service is that consumers around the world have expanded their demand for connectivity across time and space.[11] That is, the concept of universal service as a measure of service to physical *locations* is giving way to concepts of connecting *individuals* at all times and across geography.

The FCC's subscribership measures have for some time attempted to capture one aspect of connectivity for individuals rather than connectivity for buildings or locations. The subscribership surveys have for some time included questions regarding the "availability" of telephone service; those with service available include both telephone subscribers and those with access to telephone service outside of the residence *per se* (through the telephone of nearby neighbor or pay phone).[12]

With some reflection, the demand for access over time is quite intuitive. Telecommunications services are, as with most services (and unlike products), demanded and supplied within a specific time period. These services are non-storable by either consumers or producers; there is no inventory of calling minutes available to sit on a shelf in a provider's warehouse. A minute of calling potentially available through existing facilities is gone and forever irretrievable once that minute is passed. Periods of time when a person does not have network access essentially represent periods of time for which they are not connected and are not part of universal service. [13]

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[11] Einstein's general theory of relatively is not required (nor is his special theory) to understand consumers' demands for connectivity. And while the gravity of this change in demand may not bend the fabric of space/time, it is bending concepts of connectivity and universal service. *See* (or do not see since it is not required) ALBERT EINSTEIN, RELATIVITY: THE SPECIAL AND GENERAL THEORY. (New York: Henry Holt 1920) *available at* (http://www.bartleby.com/173/).

[12] *See, e.g.*, FCC, TELEPHONE SUBSCRIBERSHIP IN THE UNITED STATES (January, 1997) *available at* (http://www.fcc.gov/Bureaus/Common_Carrier/Reports/FCC-State_Link/IAD/subs1196.pdf) (including the question: "Is there a telephone elsewhere on which people in this household can be called?").

[13] FCC Commissioner Robert McDowell recognized as much in a recent speech criticizing the "fundamentally flawed" report of the Organisation for Economic Cooperation and Development (OECD) that gave the United States a relatively low ranking on broadband penetration rates. Commissioner McDowell noted, with respect to broadband, that adoption and connectivity are not limited to hard-wired connections at a user's residence: ""The OECD conclusions really unravel when we look at Wi-Fi. The study simply omits the fact that one-third of the world's Wi-Fi hot spots are in the U.S. Wi-Fi is not included in the OECD study unless it is used in a fixed wireless setting. I don't know about you, but I can't recall ever seeing any fixed wireless users cemented into a Starbucks. Most Americans who use Wi-Fi use it with personal portable devices. So it is impossible to determine how many Wi-Fi users are active at any given moment. Additionally, 3G mobile technologies are excluded from the OECD stats. But I'll talk more about America's great strides in the wireless realm shortly. And have I mentioned that the study does not attempt to measure consumers who use broadband services at work instead of at home? In short, the OECD data do not include all of the ways Americans can obtain high-speed connections to the Internet, therefore omitting millions of American broadband users." Commissioner McDowell cogently concluded, "[C]onsumers don't buy fat pipes; they buy applications and content that require fat pipes." Luncheon Address, FCC Commissioner Robert M. McDowell, Broadband Policy Summit III, Crystal City, VA (June 7, 2007) (available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-273742A1.pdf). *See* Sections 5.b. and 6.c. below.

As people move, their demand for connection moves with them. People demand connectivity across space. A person that only has access for nine months of the year, but travels to a location that does not have network access (because of a seasonal job, for example), has a lower level of access than a person staying in the same location with access all twelve months of the year. A person with access to a network during working hours can be said to have greater connectivity than a second person without access at home or at work; a third person with access while at work and at home has better access than either of the first two people.

Fundamentally, there is no demand for access to a network for a building, a residence, or a location *per se*.[14] Rather, any implied demand for access at any point in space is derived through the demand by the individuals who are at that point in space, over some period of time.[15] A wireless phone, therefore, represents the current ultimate (until changing technology alters future customer perceptions) in an individual's access over time and space.[16]

V. Indications of Changes in Customer's Perceptions about Connectivity

There are several factors that indicate changes in customers' perceptions about connection to a modern communications network. These changes are driven in large part by experiences with wireless connections. Today, in the U.S. and around the world, wireless service has become the predominant means of communications.

A. Growth of, and current high rates in, wireless penetration

One of the drivers of changing perceptions of connectivity has been the high rates of growth of wireless and the current high rate of penetration. This is true for both subscription and wireless usage. Significant wireless demand exists for voice communications and, more recently, for data communications as well.

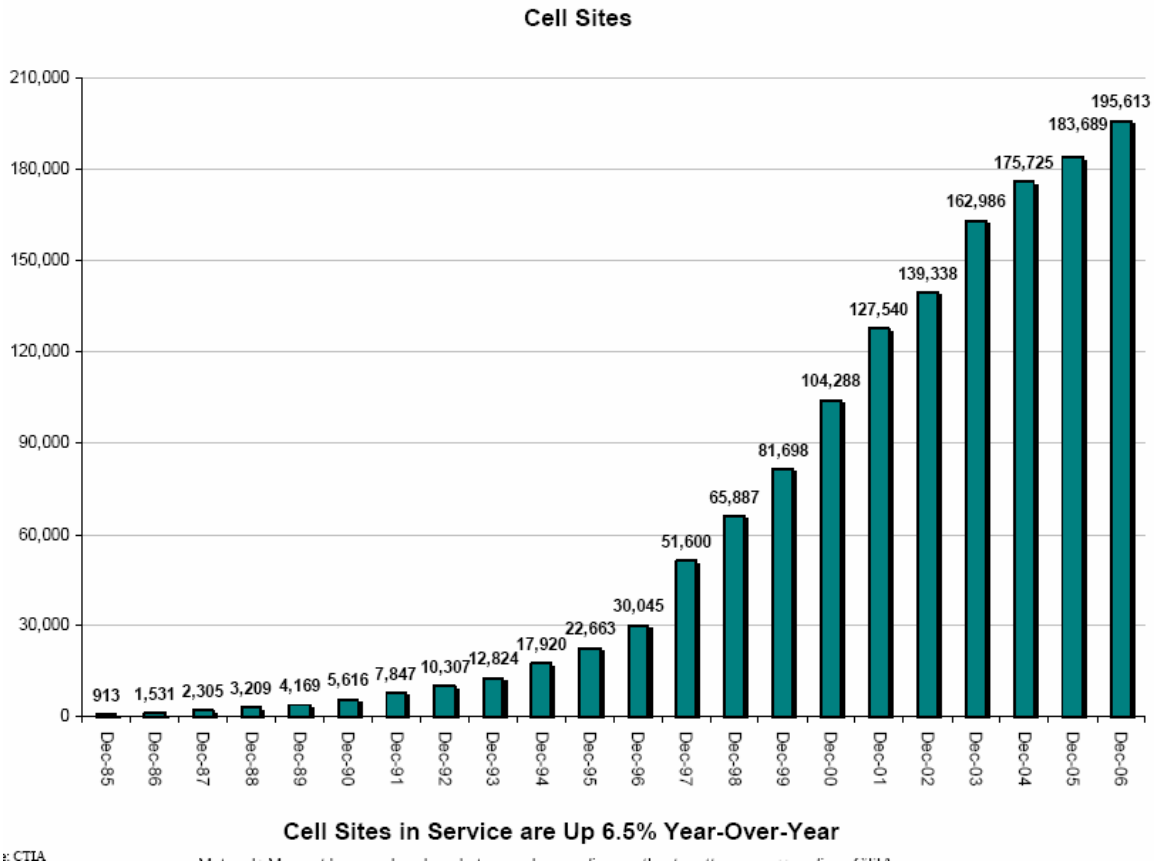
[14] The demand for access itself is a demand derived from the underlying demand for usage and an option demand (having the option for usage, even if no usage occurs).

[15] Mathematically one can think of the demand for connection for any finite period of time, e.g., a month, at a location as the summation (across individuals) of the integral of individual demand (across the time for which the individual is at the location).

[16] It is of course possible for a single phone to provide connectivity for more than one person, but as a practical matter, consider wireless telephone service as a one-for-one service.

Wireless coverage continues to expand. [17]

Fig. 1

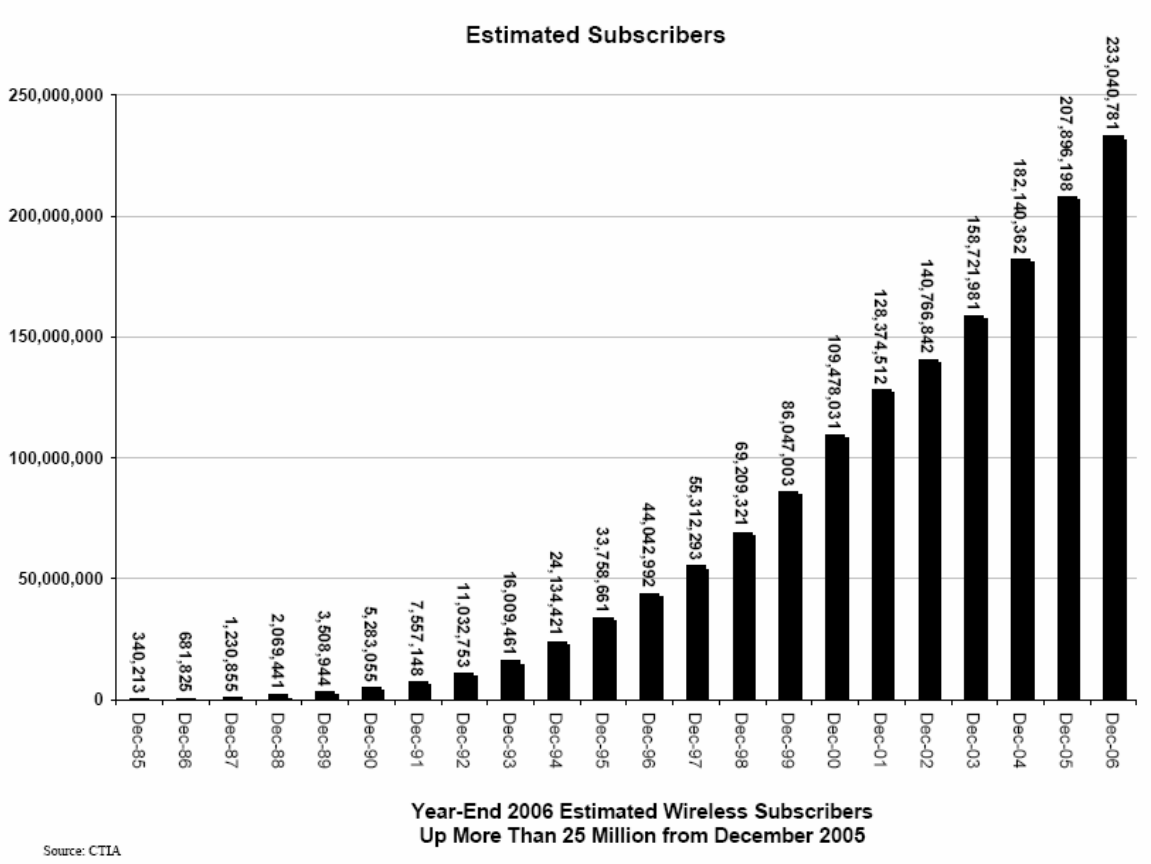


The count of total wireless subscribers also continues to grow, as seen from the graph below:[18]

Fig. 2

[17] CTIA, SEMI-ANNUAL WIRELESS INDUSTRY SURVEY (2006) (http://files.ctia.org/pdf/CTIA_Survey_Year_End_2006_Graphics.pdf)

[18] CTIA, SEMI-ANNUAL WIRELESS INDUSTRY SURVEY (2006) (http://files.ctia.org/pdf/CTIA_Survey_Year_End_2006_Graphics.pdf)



"The US mobile market in Q1 2007 continued its slow trudge towards 100% penetration, with the best part of two percentage points added in the quarter, to take the total to 79.6%. In absolute terms, there are now (an estimated) 239m mobile customers in the USA, up from 233m at the end of 2006 and 214m one year earlier."[19] CTIA provides a similar estimate of 238,265,117 U.S. wireless subscribers (as of June 12, 2007).[20]

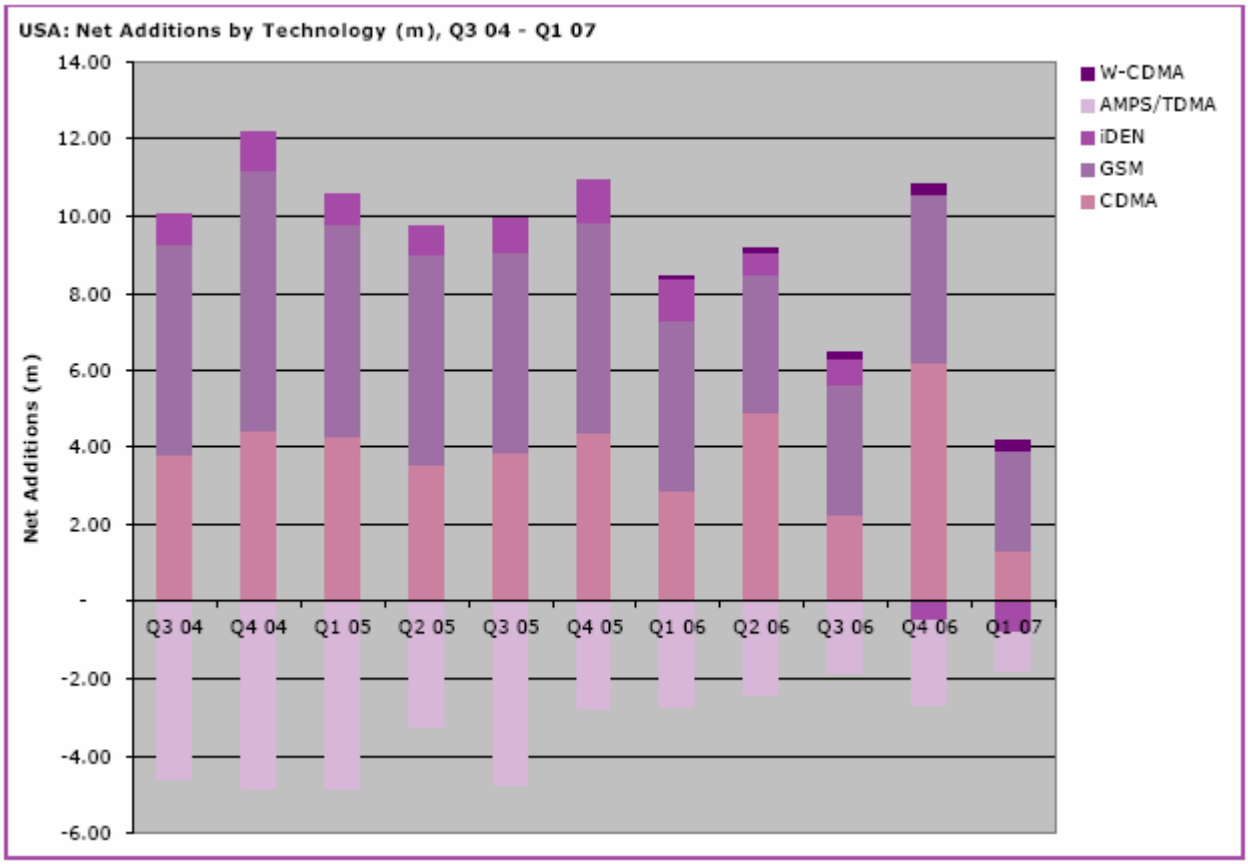
It is noteworthy that more feature-rich technologies are still adding significant numbers of subscribers, as seen below.[21]

Fig. 3

[19] *USA – Slowing Growth Suggests Further Need for Consolidation*, CELLULAR-NEWS, May 24, 2007, (http://www.cellular-news.com/story/23948.php)

[20] CTIA, Estimated Current US Wireless Subscribers, http://www.ctia.org/ (Last visited Jun. 12, 2007)

[21] *USA – Slowing Growth Suggests Further Need for Consolidation*, CELLULAR-NEWS, May 24, 2007, (http://www.cellular-news.com/story/23948.php). *See also*, *Mobile Providers Must Deal With Customer's Rising Expectations, Says Pyramid Research*, TELECOM AM, June 25, 2007, Vol. 13, No. 121.



B. Substitution of wireless subscription for land-line subscription as the method of connection to the network

In the past, wireless service was seen as an adjunct to landline telecommunications service. Wireless was considered as the optional method of connection for some users (with very high demand for connectivity across time and space). Increasingly, however, subscribers are substituting wireless service for traditional landline service. The number of wireless users in the United States, which surpassed the number of wireline users for the first time in 2005, has continued to grow, as shown in the graph in the section above.

1) Decline in wireline subscription.

Another indication is the reduction in growth and/or decline in wireline subscription.[22]

Fig. 4

[22] The decline in wireline subscription is due to a variety of factors including wireless growth, broadband substitution for second lines, and other factors.

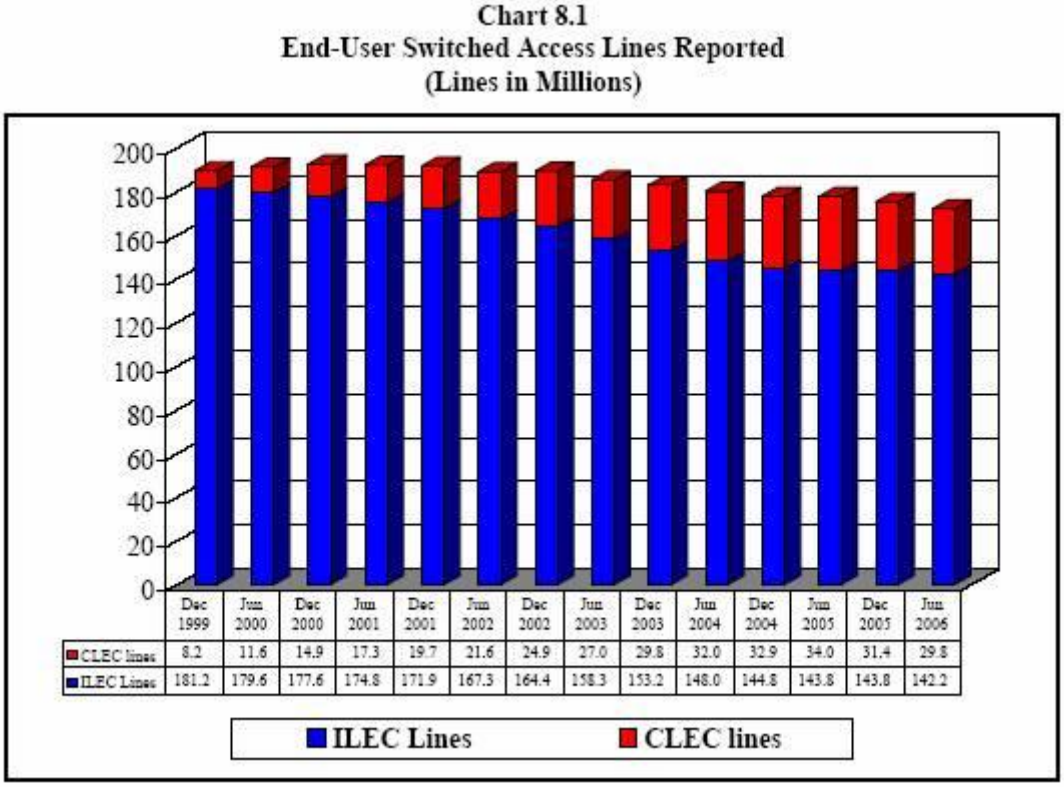
RESIDENTIAL LINE LOSS[23]

TOTAL LINES IN THOUSANDS

Company	Q306	Q305	Loss
AT&T	28,386	30,796	-7.8%
BellSouth	13,097	14,345	-8.7%
Qwest	8257	8864	-6.8%
Verizon	28,523	31,629	-9.8%

Between Q3-2005 and Q3-2006 the four major U.S. ILECs lost between 6.8% and 9.8% of their residential lines. These carriers' losses are indicative of a nationwide trend in declining subscriptions; the Telecommunications Industry Association (TIA) reports that wireline subscriptions dropped from 175.4 million users in 2005 to 161.2 million in 2006,[24] which supports earlier trend data from the FCC[25]:

Fig. 5



This trend was just beginning in 2002 for rural areas. Victor Glass (Director of demand forecasting and rate development at National Exchange Carrier Association,

[23] Carol Wilson, *Is Access Line Loss Slowing*?, TELEPHONY MAG., Nov. 6, 2006 (http://telephonyonline.com/mag/telecom_access_line_loss/). Between the third quarter of 2005 and the third quarter of 2006, Verizon's wireline subscriptions fell from 31,629,000 to 28,523,000.

[24] Denise Pappalardo, *Telecom Industry Continues to See Steady, Healthy Growth; Bundled Offerings, Residential VoIP and Wireless Adoption are Fueling Growth*, NETWORK WORLD, Jan. 25, 2007 (http://www.networkworld.com/news/2007/012507-tia.html).

[25] FCC, TRENDS IN TELEPHONE SERVICE 59 (2007) (http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-270407A1.pdf)

NECA) noted in 2002 that even though "most rural carriers haven't experienced a net line loss, [j]ust a few years ago, carriers in the NECA pool were growing access lines at around 5%, … [t]his year it will probably be less than 1%, in part due to the lowering of wireless prices."[26]

2) Substitution of wireless subscription for wireline subscription

Beyond the growth in wireless subscription and the decline of wireline, there are more explicit indications of the current predominance of wireless and wireless substitution for wireline. Even using data from 1999-2001, Professors Ward and Woroch have found significant positive cross-price elasticities between mobile and wireline usage.[27] Another study concluded: "[i]n fact, overwhelming evidence shows that wireless services are replacing wireline services. … Based on an econometric model, this paper finds conclusive evidence that wireline and wireless are substitutes. This model finds that a one percent increase in wireline prices will result in a two percent increase in wireless demand. … "it also means that price and service regulation is largely unneeded, since market forces are sufficient to hold prices in check."[28]

In 2005 "Sprint announced… that about 8,000 employees at Ford Motor will jettison their desktop phones and use cellphones exclusively"[29] Wireless providers have taken note of these trends, as evidenced by their marketing campaigns. T-Mobile has touted its product as ""the only phone you need".[30] Verizon Wireless prominently advertises the ability to allow customers to keep their landline phone numbers if they switch to wireless service.[31] It is also increasingly standard for wireless plans to offer unlimited calling to other customers of the same wireless provider and/or to family members on a family plan; Alltel has taken this one step farther by allowing subscribers to call any number – wireline or wireless – without additional charges as part of its My Circle offering.[32] These aspects of wireless plans make customers more likely to disconnect their wireline

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[26] Vince Vittore & Glenn Bischoff , *Access Line Count Evaporating*, TELEPHONY.ONLINE, Oct. 14, 2002 (http://telephonyonline.com/mag/telecom_access_line_count/)

[27] MICHAEL WARD & GLENN WOROCH, USAGE SUBSTITUTION BETWEEN MOBILE TELEPHONE AND FIXED LINE IN THE U.S. (2004) (http://www.uta.edu/faculty/mikeward/mobile%20usage.pdf)

[28] Stephen Pociask, *Wireless Substitution and Competition: Different Technology but Similar Service – Redefining the Role of Telecommunications Regulation*, 5 COMPETITIVE ENTERPRISE INST. ISSUE ANALYSIS (2005)

[29] Chris Woodyard, *Some Offices Opt for Cellphones Only*, USA TODAY, Jan. 25, 2005, at B1.

[30] GLOBAL TECHNOLOGY FORUM, THE ONLY PHONE YOU NEED?, (Oct. 2006) (http://globaltechforum.eiu.com/index.asp?layout=rich_story&channelid=3&categoryid=1&title=The+only+phone+you+need%3F&doc_id=9604)

[31] Verizon Wireless, Local Number Portability, (http://www.verizonwireless.com/b2c/LNPControllerServlet)(last visited Jun. 4, 2007)

[32] Alltel Wireless, Alltel Circle – Choose Who You Call For Free, (http://www.alltelcircle.com/) (Last visited Jun. 6, 2007).

phone.[33]

Many customers have in fact chosen wireless as the complete replacement for wireline connection. A recent Yankee Group study shows substantial rates of wireless substitution in all of the twenty largest major metropolitan areas across the country, with a high of 19% in Detroit.[34] This trend appears to encompass the entire country, as National Center for Health Statistics data indicates that by the second half of 2006, roughly one out of every eight Americans lived in a home with exclusively wireless phone service.[35] The especially high incidence of wireless substitution among younger groups, such as 18-24 year olds (of whom 22.6% live in wireless-only residences) would indicate that substitution will continue to increase.[36] This substitution of wireless for wireline need not be for the wealthy or trendy. On the contrary, evidence shows that adults living in poverty are substantially more likely to live in households with only wireless service.[37]

There also appears to be significant interest by existing combined service customers (currently subscribing to both wireless and wireline services) to completely substitute wireless via the disconnection of their wireline service in the future. Research by the Yankee Group shows the overall number of U.S. wireless users who have canceled wireline service to be rising by 1.5% every year.[38] J.P. Morgan estimates that wireless substitution will: (1) reach 20.3 million primary lines, or 18 percent of telephony households, by 2010, and (2) claim 8.5 million non-primary access lines, which in conjunction with broadband substitution, will precipitate non-primary access line losses of 11.7 percent per year; by 2010, wireless lines will have replaced about 29 million landlines, representing line substitution of 23 percent.[39] Some research predicts even higher levels of wireless-only households in the future, indicating that between 25% and

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[33] *See, e.g.*, Verizon Wireless, (http://www.verizonwireless.com/b2c/store/controller?item=familyShare&action=viewFSPlanList&catId=322)(last visited Jun. 4, 2007) (offering unlimited calling to both other Verizon customers and to members of a family plan); Cingular Wireless, (http://www.cingular.com/cell-phone-service/cell-phone-plans/family-cell-phone-plans.jsp?_requestid=626861) (last visited Jun. 4, 2007) (same for Cingular customers); Sprint, (http://www.nextel.com/en/services/calling/unl_mobile_mobile.shtml?id6=promo;mobiletomobile) (last visited Jun. 13, 2007) (same for Sprint customers).

[34] TELEPHIA TOTAL COMMUNICATIONS, MIDWESTERNERS CUT THE CORD (2006) (http://www.telephia.com/html/documents/TotalCommunications_000.pdf)

[35] *See* STEPHEN J. BLUMBERG, & JULIAN V. LUKE, DIVISION OF HEALTH INTERVIEW STATISTICS, NATIONAL CENTER FOR HEALTH STATISTICS, WIRELESS SUBSTITUTION: ESTIMATES FROM THE NATIONAL HEALTH INTERVIEW SURVEY 2 (2006) *available at* (http://www.cdc.gov/nchs/data/nhis/earlyrelease/wireless200705.pdf)

[36] *Id.* The prevalence of substitution decreases uniformly as age rises.

[37] *Id.* 15.8% of adults below the poverty line live in wireless-only households.

[38] Robin Arnfield, *Consumers Give up Land-Lines for Cell Phones*, NEWSFACTOR.COM, Oct. 22, 2004 (http://www.newsfactor.com/story.xhtml?story_title=Consumers-Give-up-Land-Lines-for-Cell-Phones&story_id=27822).

[39] J. CHAPLIN, *ET AL.*, J.P. MORGAN, TELECOM SERVICES / WIRELINE, STATE OF THE INDUSTRY: CONSUMER, p. 4 and tables 57 and 75 (Jan. 2006).

37% of Americans are expected to switch to wireless-only service by 2009.[40]

The most recent FCC report on CMRS found: "According to one survey from early 2006, while only 12 percent of cellphone users use cellphones as their only phone, an additional 42 percent said they also had a landline phone but used their cellphones 'most'". In addition, one analyst estimates that customers in nearly one third of American households make at least half their long-distance calls at home from their cell phones rather than from their landlines."[41]

These findings are supported by other research, which reports that many current wireline users are considering cutting the cord. A February 2006 In-Stat survey found that close to 20 percent of respondents that have wireless service plan to drop wireline service.[42] With more than 95 percent of the U.S. population exposed to broad wireless network coverage, the high saturation of wireless service offerings by the nation's six leading wireless carriers, and the increasingly affordability of large blocks of minutes, the Yankee Group considers wireless substitution to be "a significant and unstoppable trend".[43]

C. Substitution of wireless calling for land-line calling

1) Growth of wireless usage and decline in land-line usage

As with the substitution of wireless for wireline penetration, one indication of wireless substitution in usage is the growth in wireless calling. The CTIA reported that wireless customers used approximately 1.8 trillion minutes of service during 2006.[44] Moreover, the CTIA found that wireless minute consumption has grown by approximately 20% year after year since the statistic was first kept:[45]

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[40] INSTAT RESEARCH GROUP, CUTTING THE CORD: CONSUMER PROFILES AND CARRIER STRATEGIES FOR WIRELESS SUBSTITUTION (Oct. 2005) (http://www.instat.com/Abstract.asp?ID=231&SKU=IN0502092MCM).

[41] FCC, ELEVENTH ANNUAL REPORT TO CONGRESS ON THE STATE OF COMPETITION IN THE COMMERCIAL MOBILE RADIO SERVICES (CMRS) INDUSTRY, Conclusion ¶ 215 (2006) *available at* (http://wireless.fcc.gov/cmrsreports.html).

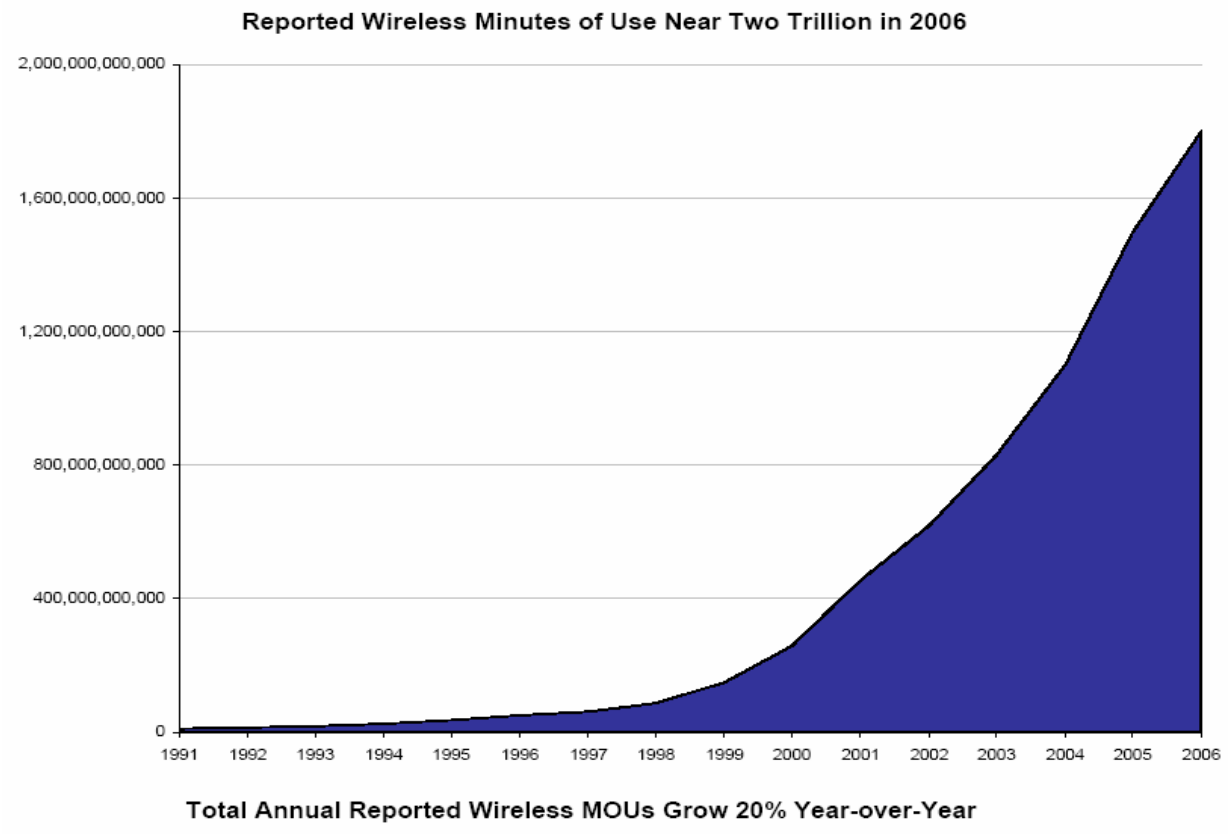
[42] *See* INSTAT RESEARCH GROUP, SURVEY SHOWS THAT WIRELINE EROSION WILL ACCELERATE; 20% OF HOUSEHOLDS PLAN TO CANCEL OR NOT USE WIRELINE SERVICES (Feb. 2006)(http://www.instat.com/newmk.asp?ID=1577)

[43] *Are Americans Cutting The Cord?*, TELECOMWEB NEWS DIGEST, Sept. 12, 2005 (http://www.accessmylibrary.com/coms2/summary_0286-9609806_ITM)

[44] CTIA, SEMI-ANNUAL WIRELESS INDUSTRY SURVEY (2006) (http://files.ctia.org/pdf/CTIA_Survey_Year_End_2006_Graphics.pdf)

[45] *Id.*

Fig. 6



The FCC found: "Wireless subscribers continue to increase the amount of time they communicate using their wireless phones. Average minutes-of-use per subscriber per month ("MOUs") jumped again in 2005, to 820 minutes, or more than 13 hours of use, for the average subscriber of a nationwide operator in the last quarter of the year."[46]

Conversely, wireline usage has continued to fall. Long-distance usage has been particularly affected, with nearly half of respondents indicating decreased landline usage, and the average decrease being 60 percent.[47] Moreover, as noted earlier, an In-Stat survey found that nearly 20% of respondents plan to drop landline phone service in the

[46] FCC, ELEVENTH ANNUAL REPORT TO CONGRESS ON THE STATE OF COMPETITION IN THE COMMERCIAL MOBILE RADIO SERVICES (CMRS) INDUSTRY, ¶ 168 (2006) *available at* (http://wireless.fcc.gov/cmrsreports.html)(citing *US Wireless Matrix 4Q05*, at 25)

[47] *Id.*

near future.[48]

Since wireless carriers receive virtually no switched access revenues in the U.S., this projected decline is purely a reflection in the decline of interstate wireline calling. In one article, "Sprint apportioned 75% of the impact [of reductions in consumer long distance voice volume] to wireless substitution."[49] This trend is not specific to the U.S. In Sweden, "[t]otal annual fixed line call revenue was estimated at SEK19.5 billion (USD2.8 billion) by the PTS, down 11% year-on-year, whilst the watchdog also reported that mobile phone usage doubled in the past two years.[50]

2) The wireless phone has become the primary phone for many users

Beyond the basic indications of wireless usage substitution, there is more specific evidence that some customers do in fact substitute wireless usage for landline usage. Of the roughly 74% of Americans who subscribe to wireless service, one quarter say that they consider their cell phone to be their primary means of communication.[51] Leap Wireless indicates that 52% of its subscribers claim that their Leap wireless phone is their primary phone.[52] "In fact, a majority of consumers currently using wireline service consider their wireless phone their 'primary' connection – if forced to choose one or the other, they say they would keep their wireless phone and give up their wireline connection."[53]

Wireless usage substitution is not isolated to urban areas. In a survey conducted back in January 2003 of counties with population density less than eight people per square mile, of those with wireless service, 48% of respondents reported that wireless service has replaced 90% or more of their landline long distance.[54] At that time, one-half

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[48] INSTAT RESEARCH GROUP, WIRELINE USAGE CONTINUES TO SLIDE (Feb. 2006) (http://www.highbeam.com/doc/1P1-118134971.html)

[49] 2020Insight.com, Wireless Killed Telecom Long Distance, http://www.2020insight.com/otherreports/wktld.htm

[50] Teleography, *VoIP subscribers up 87%*, TELEGEOGRAPHY'S COMMSUPDATE, Jun. 8, 2007 (http://www.telegeography.com/cu/article.php?article_id=18232).

[51] *About One-Quarter of Current Mobile Phone Subscribers Support Incentive-Based Advertising, According to a Survey by Harris Interactive*, PR NEWSWIRE, Oct. 6, 2006, (http://www.prnewswire.com/cgi-bin/stories.pl?ACCT=104&STORY=/www/story/10-06-2006/0004447079&EDATE=)

[52] Patrick Baltatzi, *Profiting from Customers Others Avoid*, CNN, Apr. 18, 2006, (http://money.cnn.com/2006/04/18/technology/business2_thirdscreen0418/index.htm)

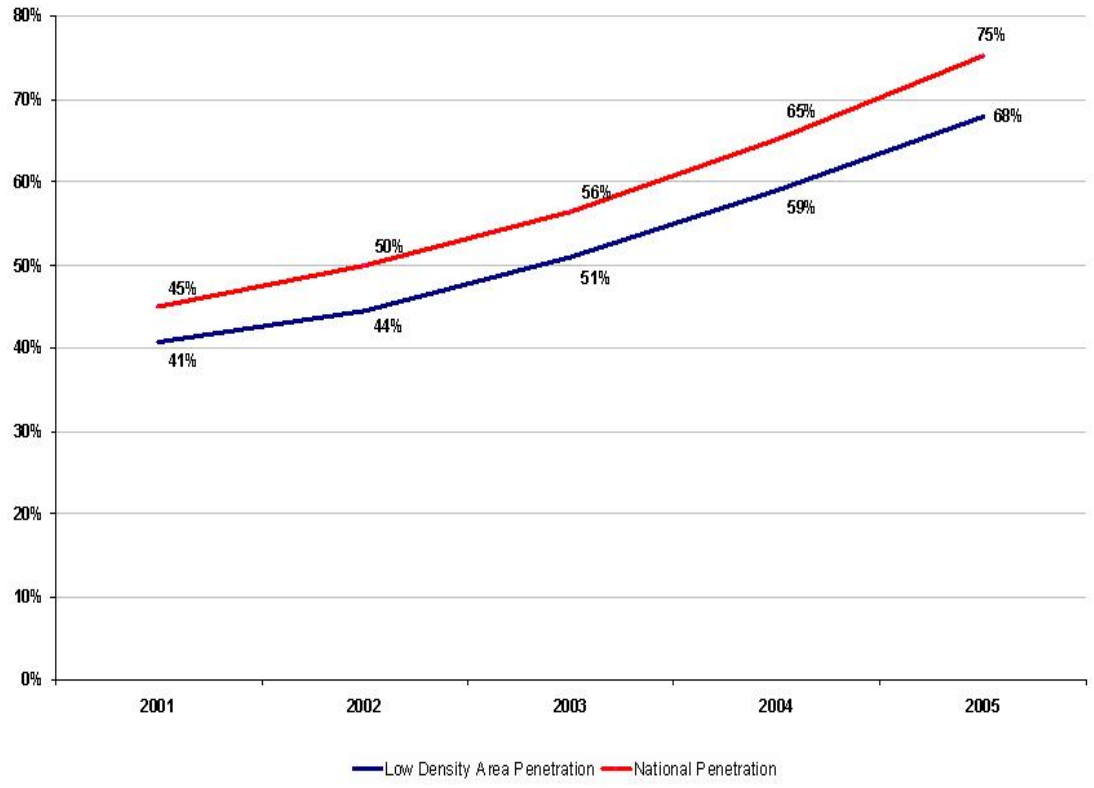
[53] Comments by CTIA to the Federal-State Joint Board on Universal Service, WC Docket No. 05-337, CC Docket No. 96-45, p. 2, May 31, 2007 (citing a survey by MyWireless.Org).

[54] WESTERN WATS, WIRELESS TELEPHONE SERVICE BECOMES ESSENTIAL COMMUNICATIONS TOOL (Feb. 2003) (January 2003 survey of 1000 wireless customers in counties with population density below eight people per square mile). *See also Facilitating the Provision of Spectrum-Based Services to Rural Areas and Promoting Opportunities for Rural Telephone Companies to Provide Spectrum-Based Services*, WT Docket No. 02-381, Comments of Western Wireless Corporation (filed Feb. 3, 2003).

of rural wireless customers "stated that their wireless phone has become more important to them and their landline phone has become less important."[55] Subscription data in the U.S. has born this out as well, with rural wireless penetration in early 2006 trailing the urban wireless penetration rate by only 3.4%.[56]

Fig. 7

Rural and National Wireless Penetration: Rural Equated with Fewer than 100 Pops per Square Mile



Source: Annual CMRS Competition Reports

An example of rural wireless growth is Leap Wireless, which markets largely to rural areas through its subsidiary Cricket, offering "a simple and affordable wireless solution alternative to traditional landline service offering unlimited anytime minutes within a Cricket calling area over a high-quality and all-digital CDMA network". On December 31, 2006, it had approximately 2,230,000 customers located in 22 states in the United States."[57] Leap's success is indicative of overall trends, as rural wireless

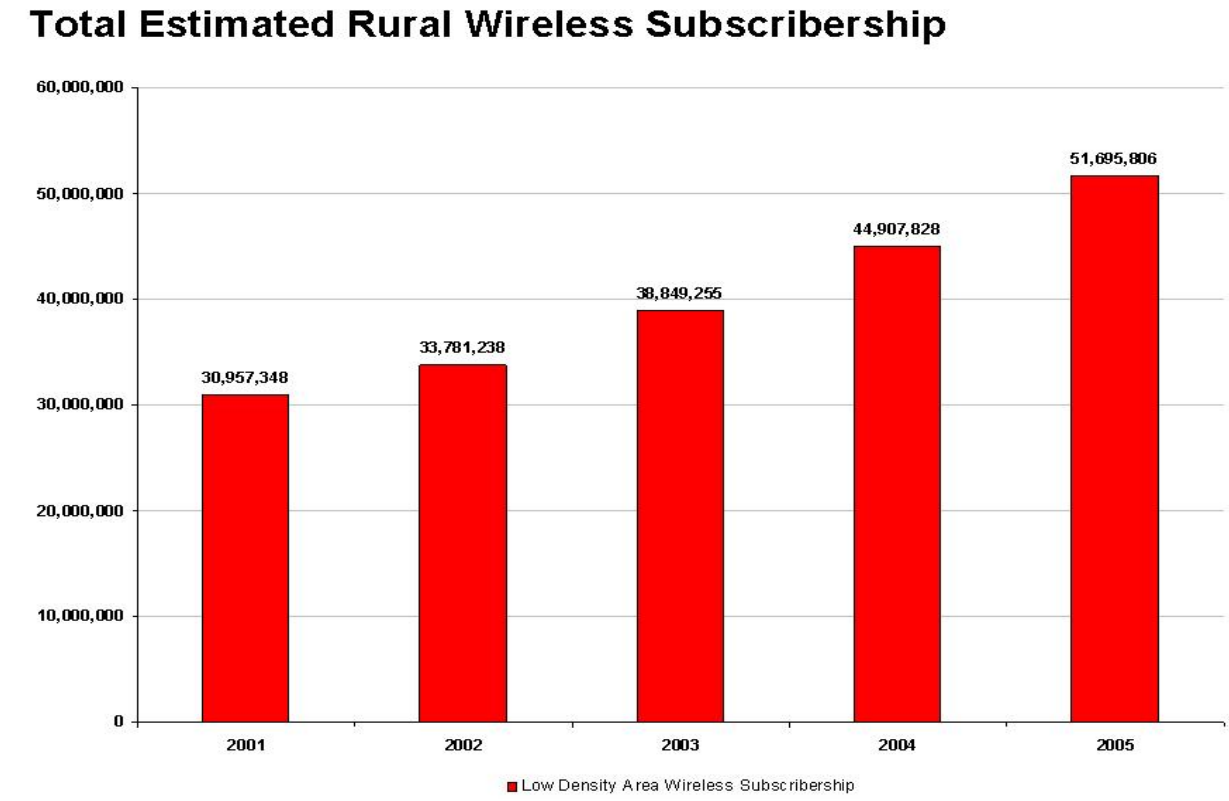
[55] *Id.*

[56] CTIA, A PLAN FOR PRO-CONSUMER, PRO-RURAL HIGH-COST UNIVERSAL SERVICE REFORM 4 (2007) (http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6518914437).

[57] Wright Investors Service, Leap Wireless International – Company Profile, http://wrightreports.ecnext.com/coms2/reportdesc_COMPANY_521863308

subscribership rose to over 50 million subscribers in 2005:[58]

Fig. 8



Source: Annual CMRS Competition Reports

Outside of the U.S., increasing wireless usage has spread to areas where consumers have never had the opportunity to own a wireline phone. In many countries wireless phones have exceeded land-line phones for years. Experts predict that worldwide wireless usage will jump from the current 2.2 billion users to 3 billion by the end of 2007, with much of the growth to come from new subscribers in emerging economies such as India, China, Africa and Latin America.[59]

[58] CTIA, A PLAN FOR PRO-CONSUMER, PRO-RURAL HIGH-COST UNIVERSAL SERVICE REFORM 5 (2007) (http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6518914437).

[59] Marguerite Reardon, *Emerging markets fuel cell phone growth*, CNET NEWS, Feb. 14. 2007, (http://news.com.com/Emerging+markets+fuel+cell+phone+growth/2100-1039_3-6159491.html)

D. Voice Over Internet Protocol (VOIP) technology contributes to the decline in circuit-switched wireline usage

Growth of VOIP has also contributed to the decline in traditional circuit-switched wireline subscription and usage, as VOIP growth strategies target both private residential and commercial/small business markets. The Yankee Group estimates that VOIP subscription will reach 14 million by the end of 2007, a relatively small share of the telecommunications market.[60] However, a survey from Boston-based Infonetics estimates the number of 2008 subscribers at 20.8 million, and a report from Framingham, Mass.-based IDC predicted almost 27 million subscribers by 2009.[61]

Small businesses and other commercial enterprises are also increasingly adopting VOIP. VOIP is currently used in some form or another by 20% of U.S. businesses, and robust business adoption of VoIP should continue, as In-Stat predicts that two-thirds of US businesses will have some form of VoIP service by 2011.[62] Similarly, AMI-Partners predicts that market penetration of hosted VoIP seats will increase from less than 2 percent in 2006 to over 7 percent by 2010, with a cumulative annual growth rate of 65 percent.[63] AMI also predicts that, while telecoms are not currently marketing VoIP services aggressively to small and medium businesses because of fears of cannibalizing their customer base and revenues, as the market growth and adoption rate increase, leading telecom service providers will become more aggressive in marketing VoIP to small and medium businesses.[64] It remains to be seen whether this considerable growth will give rise to a VoIP substitution phenomenon of the magnitude of wireless-for-wireline substitution. One source concludes "VoIP will be part of 34% of those residential subscriptions in 2010, an increase from 10% last year."[65]

I am hopeful that the June 1, 2007 decision by the D.C. Court of Appeals, vacating part of the FCC order under which VoIP providers must contribute to the USF, is only a temporary bump on the road to sound public policy.[66] Asymmetric funding (like

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[60] YANKEE GROUP, COMPETITIVE PRESSURES MOUNT IN CONSUMER VOIP MARKET (Feb. 2007) (http://www.yankeegroup.com/ResearchDocument.do?id=1558)

[61] Greg Soblete, *VoIP Growth Accelerating*, TWICE, May 25, 2005 (http://www.twice.com/article/CA603113.html)

[62] INSTAT RESEARCH GROUP, BUSINESS VOIP: MULTIPLE FLAVORS DRIVE GROWTH (Mar. 2007) (http://www.instat.com/E-Deliv/CT/2007/IN0703862CT.pdf); *See also* Andrew Hickey, *VoIP market evolves in 2007*, COMPUTER WEEKLY, Jun. 8, 2007, (http://www.computerweekly.com/Articles/2007/06/08/224630/voip-market-evolves-in-2007.htm)

[63] AMI PARTNERS, SMB INTEREST PERKS UP IN HOSTED VOIP (Apr. 2007) (http://www.efytimes.com/efytimes/fullnews.asp?edid=18543)

[64] *Id.*

[65] Dan O'Shea, *TIA study: Global telecom market at $3 trillion*, TELEPHONY ONLINE, Jan. 26, 2007, http://telephonyonline.com/voip/finance/tia_telecom_market_012607/

[66] Vonage v. FCC, 2007 WL 1574611 (DC Cir. 2007)(concluding that the FCC has statutory authority to require VoIP providers to make USF contributions and that it acted reasonably in analogizing VoIP to wireline toll service for purposes of setting the presumptive percentage of VoIP revenues

asymmetric receipt of funds) is not competitively neutral. Funding for USF should be as broad-based as possible and technology-neutral.

E. The use of dual mode phones and femtocell technology may greatly expand wireless concepts of connectivity

The growth in WiFi and WiMax deployment (see section below), has not only changed expectations about wireless data connections, it has the potential to drive major changes in voice communications as well. Some types of Dual mode phones[67] can switch between GSM/CDMA/W-CDMA and other platforms such as IEEE 802.11 (Wi-Fi). For example, T-Mobile touts its "Hot-Spot at Home" phone, expanding from its Seattle trial to a national program.[68] Such phones are likely to be increasingly common over the next few years. "According to senior analyst Philip Solis [ABI research], handsets based on the 802.11n protocol will outnumber those of other protocols in those 300 million shipments. Why? 'Cellular handset vendors have made sure that their voices have been heard in the 802.11n standards process, so they are getting all the optional features that they want.'"[69] Also, these phones offer the advantages of reducing cell congestion, increasing home quality, and preserving customers' minutes.[70] Falling costs and increased features will also drive expanded adoption of these phones: "[a]lready, there is no shortage of WLAN gadgets - it's becoming a standard feature of smartphones, as the cost of incorporating a WLAN radio has fallen to around $5 per device."[71] "Crystal ball gazers at In-Stat said Wednesday that almost half of US early adopters want their phones to include WLAN capability when they next upgrade."[72]

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generated interstate and internationally). *See also, Court Partly Vacates FCC Order Applying USF To VoIP Providers*, TELECOM AM, Jun. 4, 2007.

[67] *See* http://en.wikipedia.org/wiki/Dual-mode_phone.

[68] *See*, Tricia Duryee, *T-Mobile Brings Cellphones Home*, SEATTLE TIMES, Business & Technology, Jun. 27, 2007. http://seattletimes.nwsource.com/html/businesstechnology/2003763895_tmobile27.html. *See also*, T-Mobile, Hot Spot at Home, http://www.theonlyphoneyouneed.com/(Last visited Jun. 6, 2007); Jacqui Cheng, *T-Mobile Readying Cell-to-WiFI* Service, ARS TECHNICA, Sept. 7, 2006, (http://arstechnica.com/news.ars/post/20060907-7689.html);

[69] Nicole Fabris, *Dual-Mode Cellular/Wi-Fi Handset Shipments to Top 300 Million in 2011, But Femtocells Are the Wildcard*, ABI RESEARCH, Sept. 20, 2006. (http://www.abiresearch.com/abiprdisplay.jsp?pressid=727)

[70] Jacqui Cheng, *T-Mobile Readying Cell-to-WiFI* Service, ARS TECHNICA, Sept. 7, 2006, (http://arstechnica.com/news.ars/post/20060907-7689.html).

[71] Wifi-cellular gadgets a go go, TELECOM.COM, Jun. 14, 2007, http://www.telecoms.com/itmgcontent/tcoms/news/articles/20017432766.html?1=1&mp_articleid=20017432766&mp_pubcode=MTEL&mp_channelid=30000000378&Marlinsource=V2autoMatt&ST=OEM&MarlinViewType=ARTICLEVIEW&siteid=30000000461&from=M@T-SideNews.

[72] *Id.*

Wi-Fi enabled handsets, however, may have to compete with the upcoming opportunity of femtocells (or access point base stations),[73] the new, small cellular base stations designed for use in residential or corporate environments.[74] Like Wi-Fi access points they connect to the customer's own broadband connection. Their lure is of greater network efficiency, reduced churn, better in-building wireless coverage, and the abilities to shape subscriber data usage patterns and to build platforms upon which fixed-mobile convergence services can be realized – essentially the same reasons for using Wi-Fi-enabled handsets."[75]

F. Value characteristics of wireless services

Understanding the underlying demand characteristics of wireless services is important to understand the paradigm shift. This section briefly describes the key characteristics of wireless services, and how they affect the demand for connectivity and the importance of wireless to universal service. A more detailed analysis of the characteristics of wireless services and the degree to which they affect the demand for connectivity is beyond the scope of this paper.

Not surprisingly, the most obvious, and probably the most important, characteristic of wireless service is mobility. It is not a coincidence that the most generic name for wireless voice services is "mobile." Mobility is the primary factor that has provided the impetus for the change in perceptions about connectivity. Individuals, rather than locations, demand (in the economic sense) connection to a network. Mobile technology provides a ready method to meet this demand. Embedded in concepts of mobility, and the value of mobility, are other value characteristics that are derived from mobility. These include factors such as safety/security derived from being able to make emergency calls from any location.[76] The FCC's Consumer Facts page states "For many Americans, the ability to call 911 for help in an emergency is one of the main reasons they own a wireless phone."[77] To that end, the FCC has mandated that wireless providers insure that

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[73] *See, e.g.*, Press Release, 2Wire Raises the Bar on Fixed-Mobile Convergence by Integrating Femtocells into its Residential Gateways, Mar. 21, 2007, (http://www.2wire.com/?p=95&pid=160)

[74] *See generally* http://www.femtoforum.org/index.html (femtocell forum).

[75] *Id.*

[76] Nate Poppino, *Removing the Leash: For Many, Cell Phones -- Alone -- Are the Way to Go*, TIMES-NEWS (Idaho), Jul. 29 2006, *available at* (http://www.redorbit.com/news/technology/593510/removing_the_leash_for_many_cell_phones__alone_/index.html?source=r_technology) ("While she had no solid figures, Jones said she would guess about 65 percent of 911 calls that come through her dispatch are from cell phones"). *See also* FCC, WIRELESS 911 (http://www.fcc.gov/cgb/consumerfacts/wireless911srvc.html)

[77] FCC, WIRELESS 911 (http://www.fcc.gov/cgb/consumerfacts/wireless911srvc.html)

at least 95% of their subscribers have "location-capable handsets" that allow 911 operators to determine a caller's precise location; wireless provider Alltel has stated that it is on schedule to achieve this goal by June 30, 2007.[78]

While mobility is critical, it is not the only characteristic that determines the demand for wireless services. Other factors that are apparently important to customers are: 1) coverage; 2) more responsive customer service (e.g., same-day initiation of service); 3) in-network (intra-network) calling options that customers to place free calls to other people on the same network;[79] 4) availability of text messaging and mobile instant messaging; 5) availability of internet access; 6) voice recognition and hands-free capabilities, 7) other features such as longer battery life, cameras, calendars, calculator, watch, games, global positioning;[80] 8) number of minutes bundled with access; and 9) of course demand is determined in large part by prices (which continue to fall). Moreover, demand may be greater with the combination of the array of now-typical mobile phone capabilities as well as newer capabilities a single platform and/or device. The degree of success of devises like Apple's iPhone[81] will provide an indication of the value customers place on increasingly combined-capability devises, at least at current prices. Certainly, analysts expectations for the iPhone are high; Apple's stock price has increased 30% since it's January announcement of the product.[82]

Another part of the recent appeal of wireless services is the fall in wireless prices over time, in particular, compared to wireline local telephone prices. Measures of price changes in mobile are somewhat troublesome since average bundled minutes are generally rising and new phones tend to have additional features and functions. The FCC's Annual CMRS Report provides a variety of sources estimating price changes over time.[83] The significance of the price reductions was estimated to be as great as a 72%

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[78] *Alltel Expects To Meet Location-Capable Phone Goal This Month*, TELECOM A.M., Jun. 6, 2007

[79] *Are Americans Cutting The Cord?*, TELECOMWEB NEWS DIGEST, Sept. 12, 2005 (http://www.accessmylibrary.com/coms2/summary_0286-9609806_ITM)

[80] See, e.g., *Mobile Providers Must Deal With Customer's Rising Expectations, Says Pyramid Research*, TELECOM AM, June 25, 2007, Vol. 13, No. 121.

[81] *See iPhone to Land June 29*, TELECOMS.COM, Jun. 4, 2007, (http://www.telecoms.com/itmgcontent/tcoms/require-reg.html?prevurl=/tcoms/news/articles/20017429559.html&artid=20017429559&producttype=news&from=M@T-TopNews) ("A series of adverts that aired on US TV on Sunday night [June 3, 2007] revealed that the long awaited Apple iPhone is due to be released on June 29.") *See also* http://www.apple.com/iphone/. *See also*, John Markoff, *With the iPhone, Steven Jobs casts a spell on the American consumer*, INT'L HERALD TRIB., Jun. 3, 2007, (http://www.iht.com/articles/2007/06/03/business/wireless04.php)

[82] *iPhone makes its U.S. debut*, U.S. TELECOM DAILY LEAD, June 29, 2007.

[83] FCC, ELEVENTH ANNUAL REPORT TO CONGRESS ON THE STATE OF COMPETITION IN THE COMMERCIAL MOBILE RADIO SERVICES (CMRS) INDUSTRY 105 (2006) *available at* (http://wireless.fcc.gov/cmrsreports.html) at ¶ 150-156. (Note, price index reductions for wireline toll services during some period were greater than the reductions in the price index for total mobile services.)

reduction in average revenue per minute over the last five years.[84] The FCC's table of price reductions (as measured by average revenue per minute), shown below, displays a relatively consistent trend over the last decade.[85]

Fig. 9

Table 10: Average Revenue Per Minute

	Average Local Monthly Bill	Minutes of Use Per Month	Average Revenue Per Minute	Annual Change
1993	$61.49	140	$0.44	
1994	$56.21	119	$0.47	8%
1995	$51.00	119	$0.43	-9%
1996	$47.70	125	$0.38	-11%
1997	$42.78	117	$0.37	-4%
1998	$39.43	136	$0.29	-21%
1999	$41.24	185	$0.22	-23%
2000	$45.27	255	$0.18	-20%
2001	$47.37	380	$0.12	-30%
2002	$48.40	427	$0.11	-9%
2003	$49.91	507	$0.10	-13%
2004	$50.64	584	$0.09	-12%
2005	$49.98	740	$0.07	-22%

Moreover, such average revenue per minute measures do not capture the value to consumers of additional vertical features over time (e.g., mobile internet, MP3 players, picture message capability). During the time period December 1997 to December 2005 the wireline local telephone service CPI rose 28.5%.

[84] *Id* at ¶ 150, citing *Drops in Cellular Fees to Slow: Sprint Exec*, BOSTON.COM, Mar. 29, 2006 (citing Ovum analyst Roger Entner); *Analysts, Carriers Disagree on Wireless Pricing*, COMMUNICATIONS DAILY, Mar. 31, 2006, at 8 (citing Susan Eustis, principal at Wintergreen Research).

[85] Appendix A, table 10.

G. Local v. long distance distinctions are blurring

The traditional distinction between local and long-distance calling was largely driven by two historical wireline factors. First, there was a long-standing policy of having long distance telecommunications service help to cross-subsidize wireline local service.[86] However, these subsidies have been reduced over time. And second, originally, wireline costs of long distance service were significantly higher than local service. Transmission costs and switching costs were significantly higher decades ago. Today, fiber-optics transmission facilities and digital switching have drastically narrowed the gap between local and long distance costs. Wireless providers generally make no distinction between "local" and "long distance" services. Today, many wireless providers offer bundles of minutes that include local and long-distance calls.

Many years ago, wireline providers began eliminating the distance component to long distance service. Distance-sensitive long distance pricing gave way to a single per-minute charge for long distance calling. Customers tended to prefer the simplicity and certainty of a single charge for calling. During the same time period, prices of "long distance" calling also fell significantly. Even in the wireline environment, customers were changing their concepts of calling to one in which usage was simply usage. Indeed, wireline providers are increasingly marketing bundles of local and unlimited long distance calling.[87] In this instance, the wireless paradigm, where usage is usage, regardless of the distance of the call, is now driving marketing plans as providers strive to meet the demands of customers.

H. Predominance of cordless phones and other unlicensed wireless devices has changed perceptions of connectivity

The growth and acceptance of wireless devices in general (many of them unlicensed) has changed perceptions of connectivity.[88] "One thing is certain, unlicensed wireless

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[86] *See, e.g.*, Steve Parsons, *Cross-Subsidization in Telecommunications*, 13 J. OF REG. ECON. 157-82 (1998) *available at* (http://www.parsonsecon.com/parsonsecon/publications.html)(surveying the economics literature on this topic).

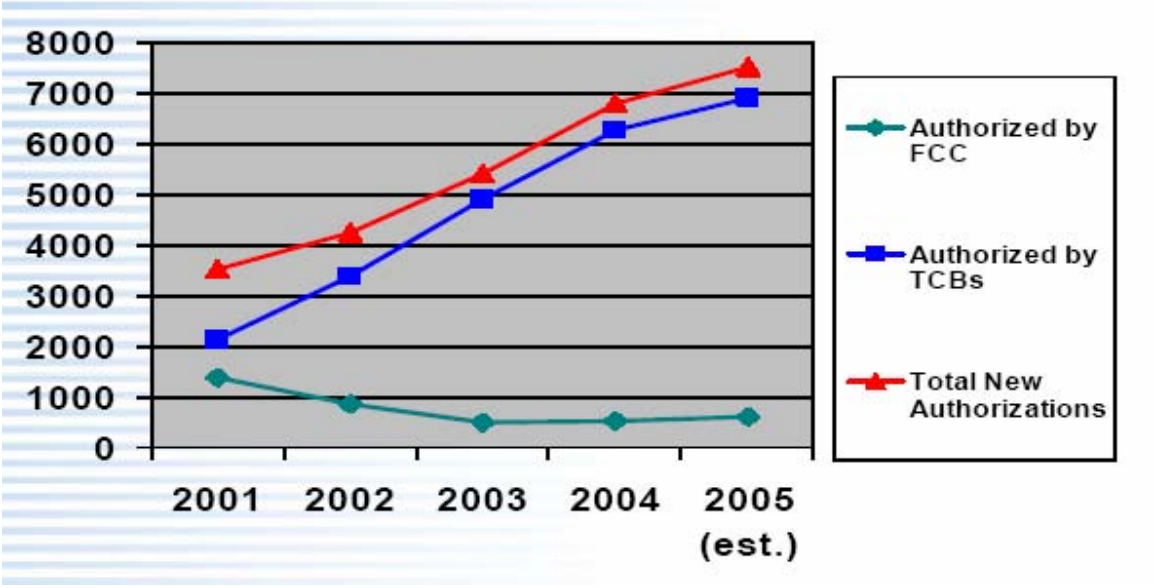
[87] *See SBC Goes Unlimited*, DIGEST, Apr. 3, 2003, (http://www.thedigest.com/more/151/151-006.html). *See also*, Jim Duffy, *RBOCs gain approval, launch long-distance services*, NETWORK WORLD FUSION, Apr. 16, 2003 (http://www.nwfusion.com/edge/news/2003/0416rbocs.html) ("Consumers can order an unlimited calling plan, Verizon Freedom, which includes all direct-dialed domestic calls -- local, regional and long-distance -- as well as calls to Canada and U.S. territories. The package includes voice mail, caller ID, call waiting, three-way calling and speed dialing of eight numbers. The monthly cost for Verizon Freedom is $49.95, plus state and local taxes.").

[88] *See generally*, KENNETH CARTER, AHMED LAHJOUJI & NEAL MCNEIL, OFFICE OF STRATEGIC PLANNING AND POLICY ANALYSIS, FCC, UNLICENSED AND UNSHACKLED: A JOINT OSP-OET WHITE PAPER ON UNLICENSED DEVICES AND THEIR REGULATORY ISSUES, Working Paper Series, (May 2003) *available at* (http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-234741A1.pdf)

devices have become pervasive, reaching nearly every household in the US. The Consumer Electronics Association estimates that there is an installed base of more than 348.23 million Part 15 consumer electronics devices; that is, more than one for every US citizen."[89] By 2002 there were 12,723 general unlicensed devices (Part 15C, including authorizations for changes to existing devices). A 2003 study (presumably with older data) shows that cordless phone penetration had reached approximately 81% with 41% penetration for garage door openers, and lower levels for other devices.[90]

Other wireless devices include: keyless entry systems, home security systems, walky-talkies (nor FRS), wireless routers, remote control devices (e.g., toys, TVs), radio frequency identification (RFID), motion activated sensors (e.g., lights), wireless dog fences, EZ-Pass (freeway sensors); SpeedPass (wireless detection and payment systems at e.g., gas stations); Wi-Fi, W-LANs, wireless PBXs and other network communications devices; wireless telemetry (e.g., wireless heart monitors); distance sensors (e.g., car bumpers); ultra wideband technologies (e.g., ground penetrating radar). Authorizations of Part 15 devices continue to rise, as seen below.[91]

Fig. 10



In total the growth in and ubiquity of these devices has changed perceptions of connectivity. The cordless phone in particular has been influential; it has a long history

[89] *Id* at 22.

[90] *Id.*

[91] GEORGE TANNAHILL, OFFICE OF ENGINEERING AND TECHNOLOGY LABORATORY DIVISION, FCC, INTRODUCTION TO FCC RULES AND INTRODUCTION TO FCC RULES AND EQUIPMENT AUTHORIZATION PROGRAM EQUIPMENT AUTHORIZATION PROGRAM OCTOBER 2005 TCB WORKSHOP. *available at* (http://www.fcc.gov/oet/ea/presentations/files/oct05/Intro_to_FCC_Policy_GT.pdf)

and provides mobility within homes and businesses.[92] The latest wave of cordless phones is VoIP cordless phones.[93]

I. Increased Importance of "Data" and High Speed to Connectivity

Throughout the great majority of the 20th century, voice communications dominated communications and notions of connectivity. However in the new millennium customer perceptions (both business and residential) of the importance of connectivity are increasingly focused on data.

1) Growth in internet subscription and usage has changed perceptions of connectivity

Internetworldstats shows 69.9% of the U.S. population uses the internet (compared to 14.1% for the rest of the world), a 124.4% growth in the U.S. since 2000.[94] Internet usage for the age group 18-49 is approximately 83%; and for the highest income classifications it is 94%.[95] Internet usage has grown significantly in the past, but appears to have flattened out in the last few years. A 2004 study shows "the average Internet user spends 3 hours per day online, almost double the 1.7 hours the average respondent spends watching television."[96] This study found that approximately one/third of all on-line time occurs at work.

Another study finds: [97]

Fig. 11

[92] Jim Charny, *E-mail to land in cordless phones*, CNET NEWS, Apr. 12, 2002 (http://news.com.com/2100-1033-882085.html).

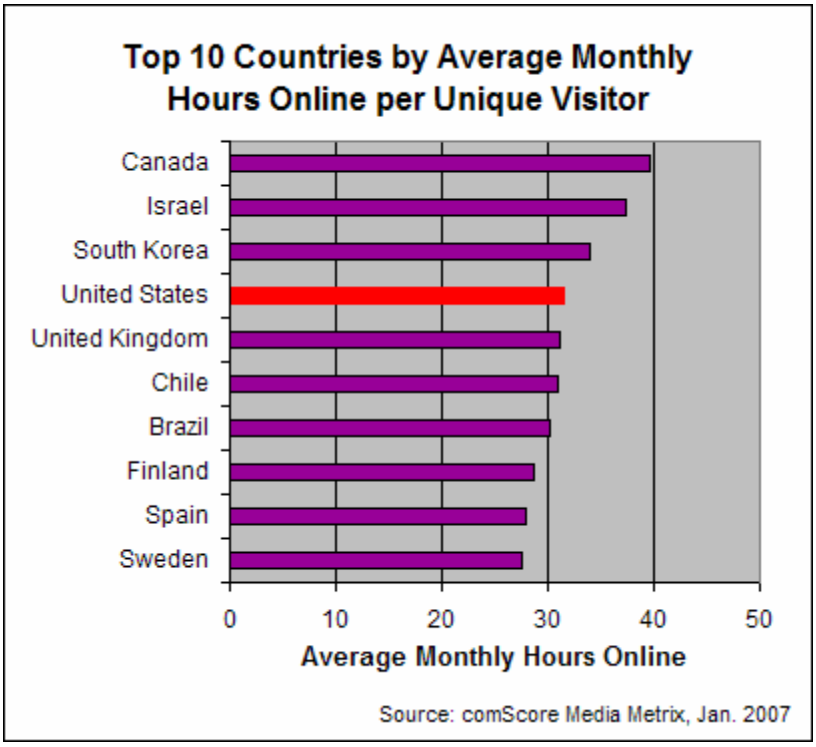
[93] *See, e.g., Linksys Debuts Cordless Skype VOIP Handset*, DEVICE FORGE, Oct. 11, 2005, (http://www.deviceforge.com/news/NS4571213183.html); *New Series of Siemens IP Phones Aimed at Non-PC Literate and SMB Market*, SDA ASIA, Jun. 8, 2007, (http://www.sda-asia.com/sda/features/psecom,id,1229,nodeid,1,_language,Singapore.html).

[94] Internet World Stats, North American Internet Usage Stats and Population Statistics, http://www.internetworldstats.com/stats14.htm. (Last visited Jun. 6, 2007)

[95] The Content Wrangler, American Internet Usage Statistics, http://thecontentwrangler.com/article/american_internet_usage_statistics/, (Last visited Jun. 6, 2007)

[96] Rob McGann, *Internet Edges Out Family Time More Than TV Time*, CLICKZ STATS, Jan. 5, 2005, http://www.clickz.com/showPage.html?page=3455061

[97] Website Optimization, US Broadband Penetration Breaks 80% Among Active Users, http://www.websiteoptimization.com/bw/0703/, (Last visited Jun. 6, 2007)



2) Growth in broadband has changed perceptions of connectivity

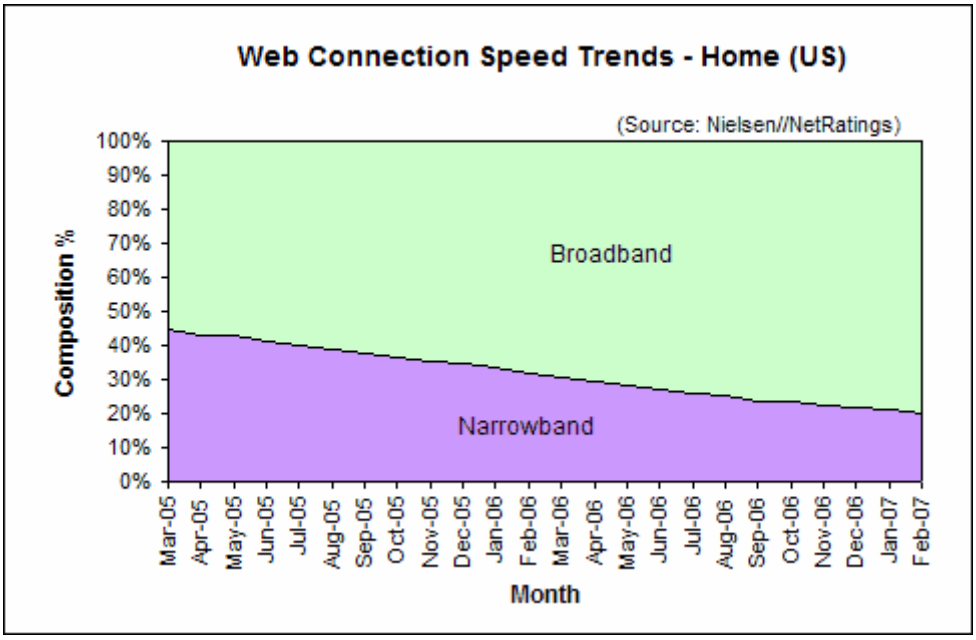
Along with the growth in internet subscription and internet usage is the very rapid rates of growth in broadband connections. One indication of the importance of broadband is seen in a recent article evaluating the EC's policy for state aid for broadband, stating "The European Commission considers widespread broadband coverage as crucial for fostering growth and employment in the European Union. … The Commission explicitly recognises the role state aid has to play in achieving widespread broadband access in the EU, in particular in rural and remote areas, and its decisions provide guidance on how to design public support for broadband projects that are compatible with the state aid rules."[98] A Leichtman Research report indicates that: "[b]roadband subscribership jumped 20% the past year, [and that] among U.S. homes with Internet service 72% had high- speed access as of March. In 2006, 60% of homes subscribed."[99] Another study found even higher levels of broadband penetration; as can

[98] Paris Anestis, Stephen Mavroghenis & Eleftheria Psaraki, *Public funding of broadband services*, EUR. ANTITRUST REV. (2007) *available at* (http://www.howrey.com/docs/Paris_Mavroghenis_Psaraki_11_EU_State_Aid.pdf)(citing Amol Sharma, *How Wi-Fi Can Extend T-Mobile's Range*, WALL ST. J., May 3, 2007, (*available at* http://online.wsj.com/article/SB117815938377190497.html?mod=home_whats_news_us))

[99] TELECOM AM, Report: U.S. Broadband Subscriptions Jumped 20% Last Year, Vol 13, No. 110, Jun. 8, 2007.

be seen from the graph below "US broadband penetration broke 80% among active Internet users in February 2007."[100]

Fig. 12

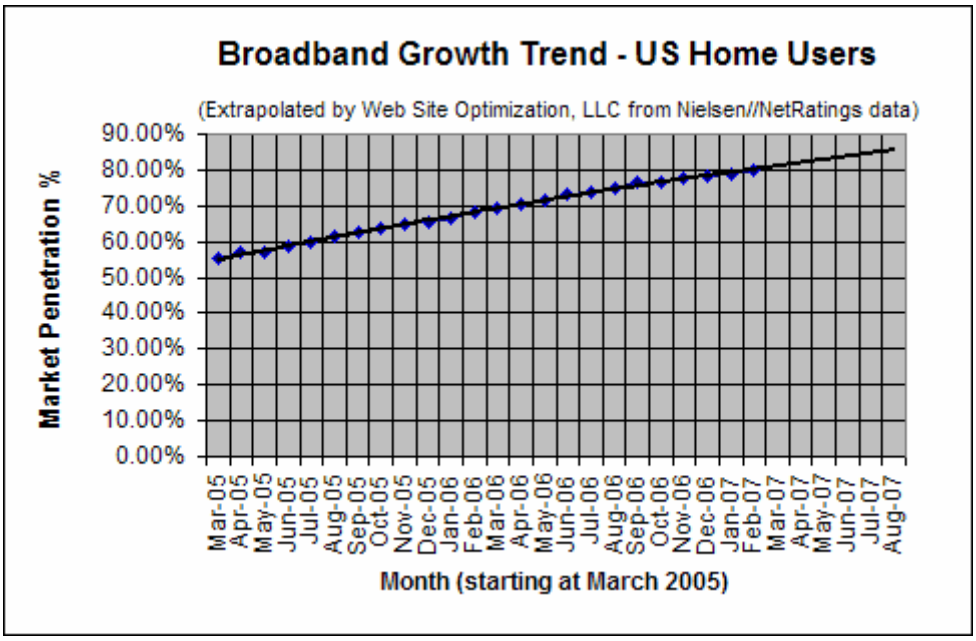


The figure below focuses on the broadband segment, including a short-term forecast.[101]

Fig. 13

[100] Website Optimization, US Broadband Penetration Breaks 80% Among Active Users, http://www.websiteoptimization.com/bw/0703/ (Narrowband users connecting at 56Kbps or less now comprise 19.84% of active Internet users) (Last visited Jun. 13, 2007).

[101] Website Optimization, US Broadband Penetration Breaks 80% Among Active Users, http://www.websiteoptimization.com/bw/0703/ (Last visited Jun. 13, 2007)



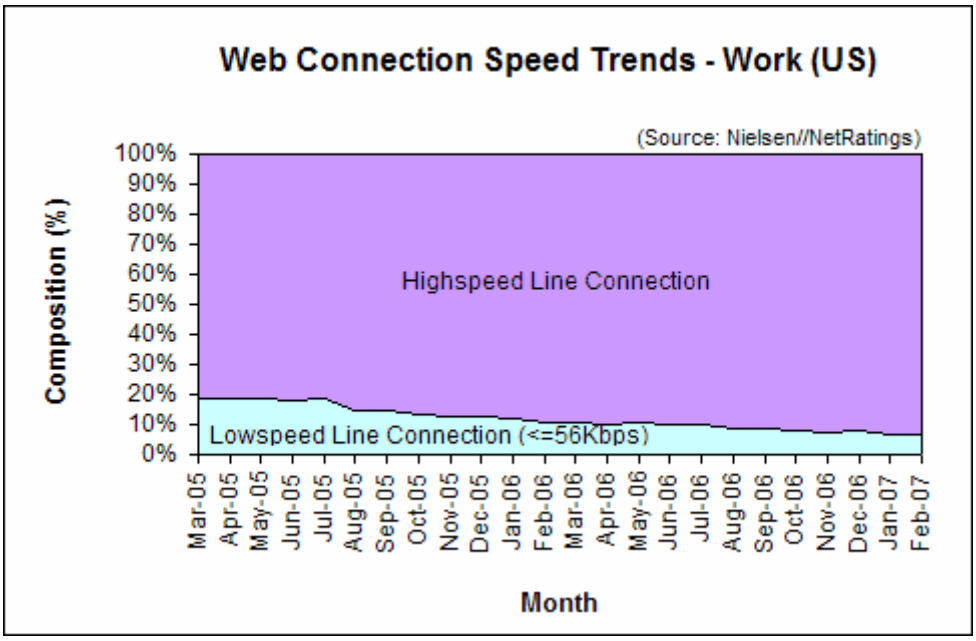
One forecast also indicates greater speeds in the future, finding that "[b]y 2010, about 75% of U.S. households will have broadband service, and about 12% of households will subscribe to very high-speed broadband (at least 24 Mb/s)." [102]

Broadband penetration is even higher in the workplace. "As of February 2007, 93.61% of US workers connected to the Internet via broadband," as illustrated by the graph below.[103]

Fig. 14

[102] Technology futures, http://www.tfi.com/ (Last visited Jun. 30, 2007)

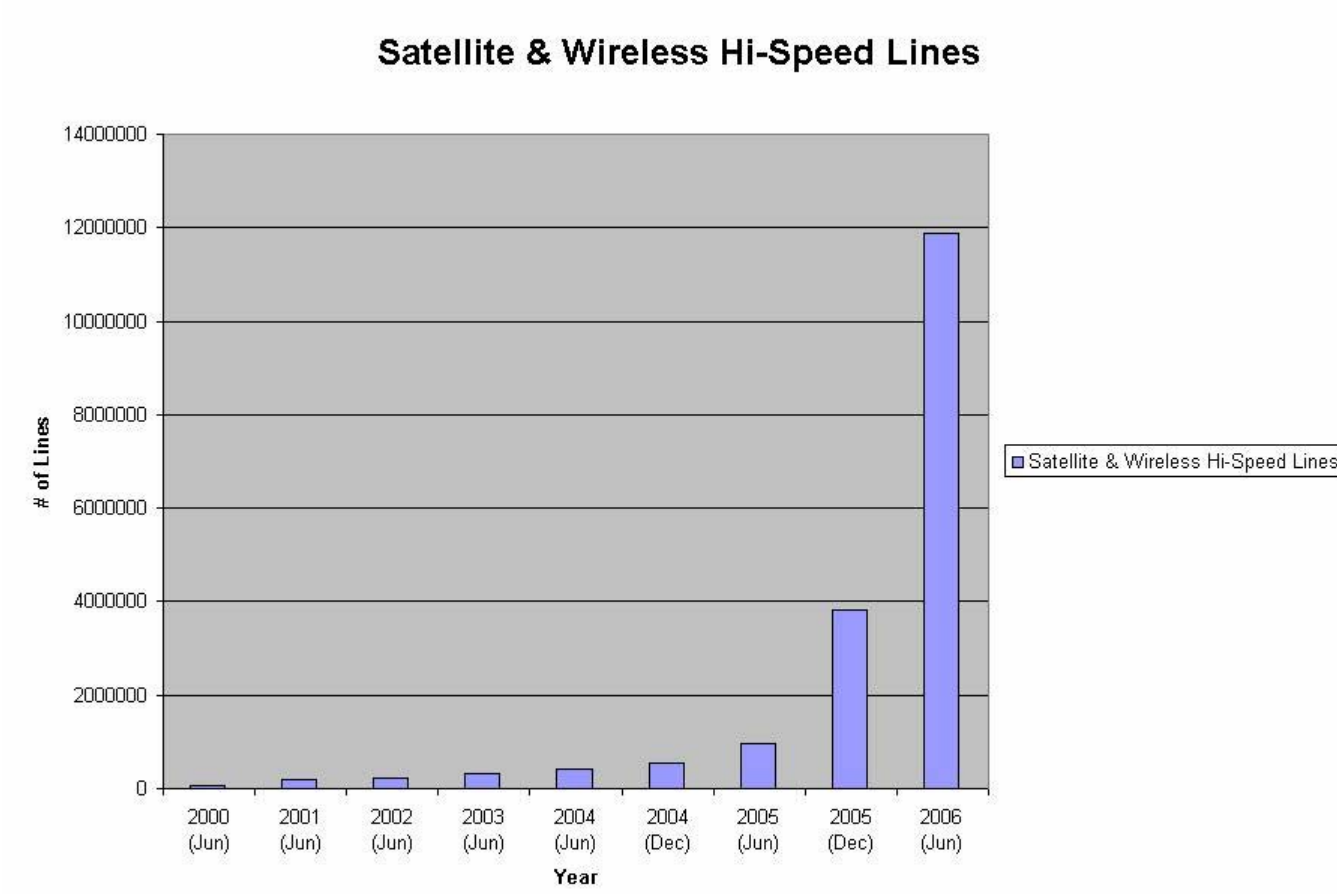
[103] Website Optimization, US Broadband Penetration Breaks 80% Among Active Users, http://www.websiteoptimization.com/bw/0703/, (Last visited Jun. 13, 2007)



As FCC data shows, wireless broadband connectivity is growing at an astonishing rate.[104] Over 11 million lines or approximately 17% of total high-speed lines in June 2006 were mobile wireless (18.4% counting satellite & fixed wireless, in the graph below).

Fig. 15

[104] FCC, HIGH-SPEED SERVICES FOR INTERNET ACCESS: STATUS AS OF JUNE 30, 2006 *available at* (http://www.c-c-g.com/FCC%20High%20Speed%20Service%20Report%20063006.pdf).



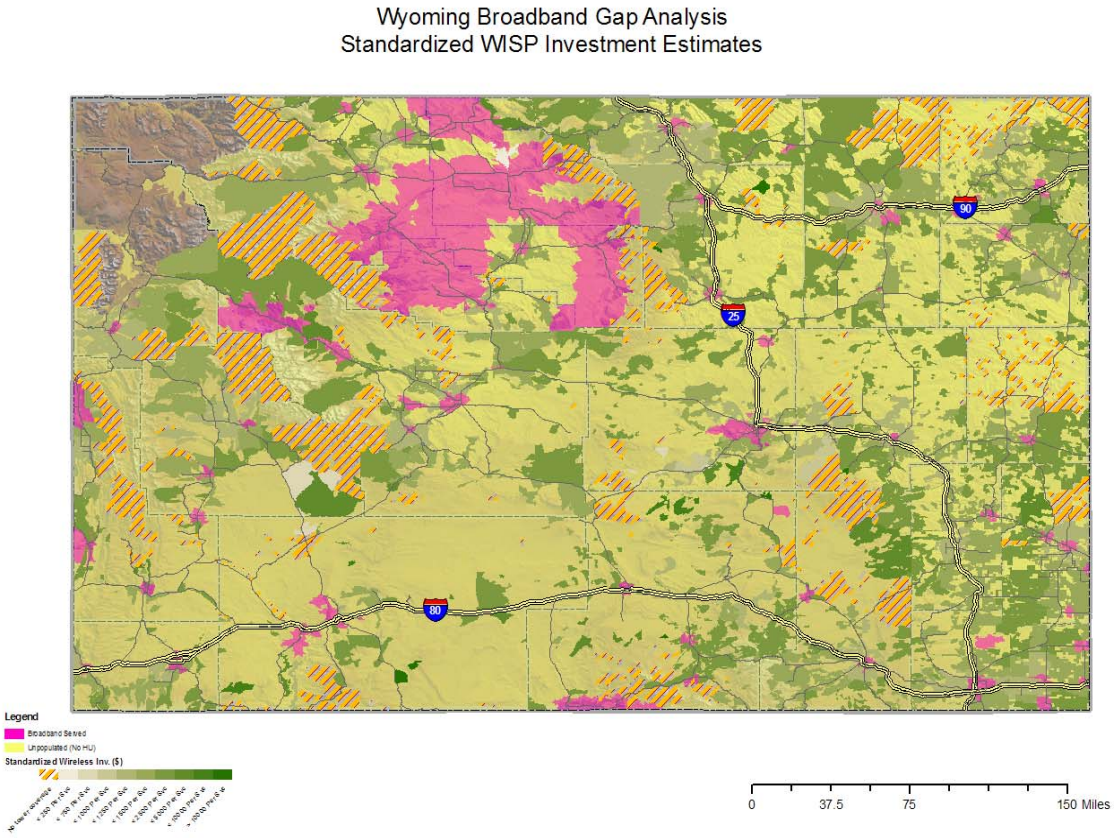
Note that the early data (2000-2003) in the graph above is annual, rather than semi-annual; therefore the recent growth is visually somewhat understated. Also, since the graph above combines mobile wireless with other technology types, the graph understates the growth in mobile wireless. In June 2005, there were less than 380,000 mobile wireless lines; this means that over a one-year time period, wireless mobile connections grew by approximately 2,900%.[105]

Wireless technologies are playing an important role in the growth of broadband, and moving the U.S. towards ubiquitous broadband coverage. This is particularly true for broadband in rural areas where longer distances and lower density make land-line broadband alternatives costly. A study of the broadband gap in Wyoming by CostQuest illustrated that wireless solutions were generally the most cost effective to fill the broadband gap.[106] "Based on the uniform light green, it is apparent that Fixed Wireless is more efficient based on land area [but not numbers of customers] and that it offers economies in the less dense portions of the state."

[105] *Id*, table 1.

[106] James Stegeman, Steve Parsons, & Mike Wilson, *Proposal for a Competitive and Efficient Universal Service High-Cost Approach*, paper provided by Alltell Wireless to the FCC, May 31, 2007, *in re* High Cost Universal Service Support, WC Docket No. 05-337, Federal-State Joint Board on Universal Service, CC Docket No. 96-45. *See also*, Cost Quest Associates, QBits, http://www.costquest.com/costquest/qbits.aspx, (Last visited Jun. 6, 2007)

Fig. 16



3) Growth and convergence in smart phones, PDAs, text messaging and mobile instant messaging is changing perceptions of connectivity

Personal digital assistant (PDA),[107] is a term that, while once popular, seems to be losing favor. "Convergence continues between smartphones, which are application-enabled, voice-centric cellular telephones, and voice-enabled, data-centric PDA's. As smartphones become more sophisticated, with more sophisticated applications and

[107] *See* http://en.wikipedia.org/wiki/Personal_digital_assistant. "Personal data assistants (PDAs) are handheld computers that were originally designed as personal organizers, but became much more versatile over the years. PDAs are also known as pocket computers or palmtop computers. PDAs have many uses: calculation, use as a clock and calendar, playing computer games, accessing the Internet, sending and receiving E-mails, video recording, typewriting and word processing, use as an address book, making and writing on spreadsheets, use as a radio or stereo, and Global Positioning System (GPS). Newer PDAs also have both color screens and audio capabilities, enabling them to be used as mobile phones (smartphones), web browsers, or portable media players. Many PDAs can access the Internet, intranets or extranets via Wi-Fi, or Wireless Wide-Area Networks (WWANs)."

services available over them, they will likely start to encroach on the market for PDA's, such as RIM's BlackBerry."[108] Between 2006 and 2007, U.S. mobile internet usage grew three-fold, tracking similar results in the U.K. and Asia.[109] Because of convergence, it is increasingly difficult to determine whether PDA-like functions are driving expanded use of mobile phones, or whether the ubiquitous use of mobile handsets is expanding PDA-like functions. This expanded use and convergence is made possible in part via common operating systems (MS Widows).

Text messaging[110] is growing in importance. In the U.S., "As of July 2006, over 10 billion text messages are sent every month – and that number has grown by 250% each year for the last two years."[111] These messages were sent, at that time, by nearly 70 million text users. The volume of text messages is project to grow to 80 billion a month in 2008.[112]

The closer-to-real-time Mobile Instant Messaging (MIM)[113] has also grown, but at a much slower rate than text messaging.[114] MIM has been also generated much smaller revenues than text messaging: $55 million v. $70 billion in 2005.[115] MIM may, however, benefit from adoption of the latest standard (IMPS V1.3)[116] and one group has forecasted revenues of $3.6 billion by 2009 for MIM.[117]

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[108] Industry Canada, Handsets, http://strategis.ic.gc.ca/epic/site/ict-tic.nsf/en/it07834e.html, (Last visited Jun. 6, 2007). *See also* http://en.wikipedia.org/wiki/Smartphone

[109] *U.S. Mobile Web Usage Said to Triple in Past Year*, TELECOM A.M., Jun. 6, 2007.

[110] *See* http://en.wikipedia.org/wiki/Text_messaging. "Text messaging, or texting is the common term for the sending of "short" (160 characters or less) text messages, using the Short Message Service, from mobile phones. It is available on most digital mobile phones and some personal digital assistants with onboard wireless telecommunications."

[111] Cellsigns, Text Message Statistics, http://www.cellsigns.com/industry.shtml, (Last visited Jun. 6, 2007)

[112] *Id.*

[113] See http://en.wikipedia.org/wiki/Instant_messaging#Mobile_Instant_Messaging.

[114] *See* America Online, *Third Annual AOL Instant Messaging Trends Survey Discovers IM Has Taken Over the Desktop*, (http://www.primenewswire.com/newsroom/news.html?d=89532) (Last visited Jun. 6, 2007) (citing 19% annual growth 2005). *See also* http://www.marketresearch.com/product/display.asp?productid=1376114&g=1.

[115] Eric Sylvers, *Wireless: Medium and messaging - Instant versus text*, INT'L HERALD TRIB., Jul. 10, 2006. (http://www.iht.com/articles/2006/07/10/business/wireless11.php)("according to In-Stat, though that is forecast to grow to more than $3.6 billion by 2009.")

[116] OPEN MOBILE ALLIANCE, OMA ENABLER RELEASES AND SPECIFICATIONS, (http://www.openmobilealliance.org/release_program/imps_v1_3.html)

[117] Eric Sylvers, *Wireless: Medium and messaging - Instant versus text*, INT'L HERALD TRIB., Jul. 10, 2006. (http://www.iht.com/articles/2006/07/10/business/wireless11.php)("according to In-Stat, though that is forecast to grow to more than $3.6 billion by 2009.")

As with many technology trends, adoption rates for text messaging and MIM are higher for younger age groups,[118] which implies growing rates of penetration over time; that is at least until the next technology displaces (or converges with) current ones.

4) Growth of WiFi and WiMax

WiFi[119] and WiMax[120] deployment has grown rapidly over time. WiFi and WiMax are being deployed in cities, small towns and rural areas,[121] at truckstops and hotels, and at college campuses.[122] The mayor of Philadelphia recently announced plans to allow Earthlink to build a 135 square mile WiFi mesh network, which will make high speed access more affordable to its residents; Earthlink will finance, build and manage the network.[123] T-Mobile is planning a launch of cellphones that can roam on WiFi hotspots in homes and coffee shops, which will carry calls over the Web thus improving indoor reception, which will, in turn, save on monthly minutes. WiFi aggregators allow access to over 100,000 WiFi hotspots with a single subscription.[124]

This deployment is not only in urban areas. For example, by the end of 2005 "In Maine, 86 percent of residents have access to broadband Internet. A year ago, Gov. John

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[118] *See, e.g.*, HARRIS INTERACTIVE, WHAT'S WRONG WITH THIS PICTURE?, http://www.harrisinteractive.com/news/allnewsbydate.asp?NewsID=1067; Gene Koprowski, *Many Addicted to Cell Phone Use*, TECHNEWSWORLD, Apr. 13, 2006 (http://www.technewsworld.com/story/49849.html).

[119] *See* http://en.wikipedia.org/wiki/WiFi "Wi-Fi, popularly known as an acronym for wireless fidelity (see below for origin), but, in actuality is simply a play on the term "Hi-Fi," was originally a brand licensed by the Wi-Fi Alliance to describe the embedded technology of wireless local area networks (WLAN) based on the IEEE 802.11 specifications."

[120] *See* http://en.wikipedia.org/wiki/Wimax. "WiMAX is defined as Worldwide Interoperability for Microwave Access by the WiMAX Forum, formed in June 2001 to promote conformance and interoperability of the IEEE 802.16 standard, officially known as WirelessMAN. WiMAX aims to provide wireless data over long distances, in a variety of different ways, from point to point links to full mobile cellular type access."

[121] *See, e.g.*, Associated Press, *Wireless Cloud Covers Rural Oregon*, WIRED, Oct. 16, 2006, (http://www.wired.com/gadgets/wireless/news/2005/10/69234); Carlson Connected, Carlson Connected Wireless VoTDM, http://www.carlsonwireless.com/carlson_votdm.php (Last visited Jun. 13, 2007)(Vendor focusing on rural areas); *Rural Rescue Mesh-ion*, UNSTRUNG, Oct. 16, 2006, (http://www.unstrung.com/document.asp?doc_id=107523)

[122] Greg Slabodkin, *Wireless Takes American Campuses by Storm*, CAMPUS TECH., Jan. 2, 2007, (http://campustechnology.com/articles/41725/)

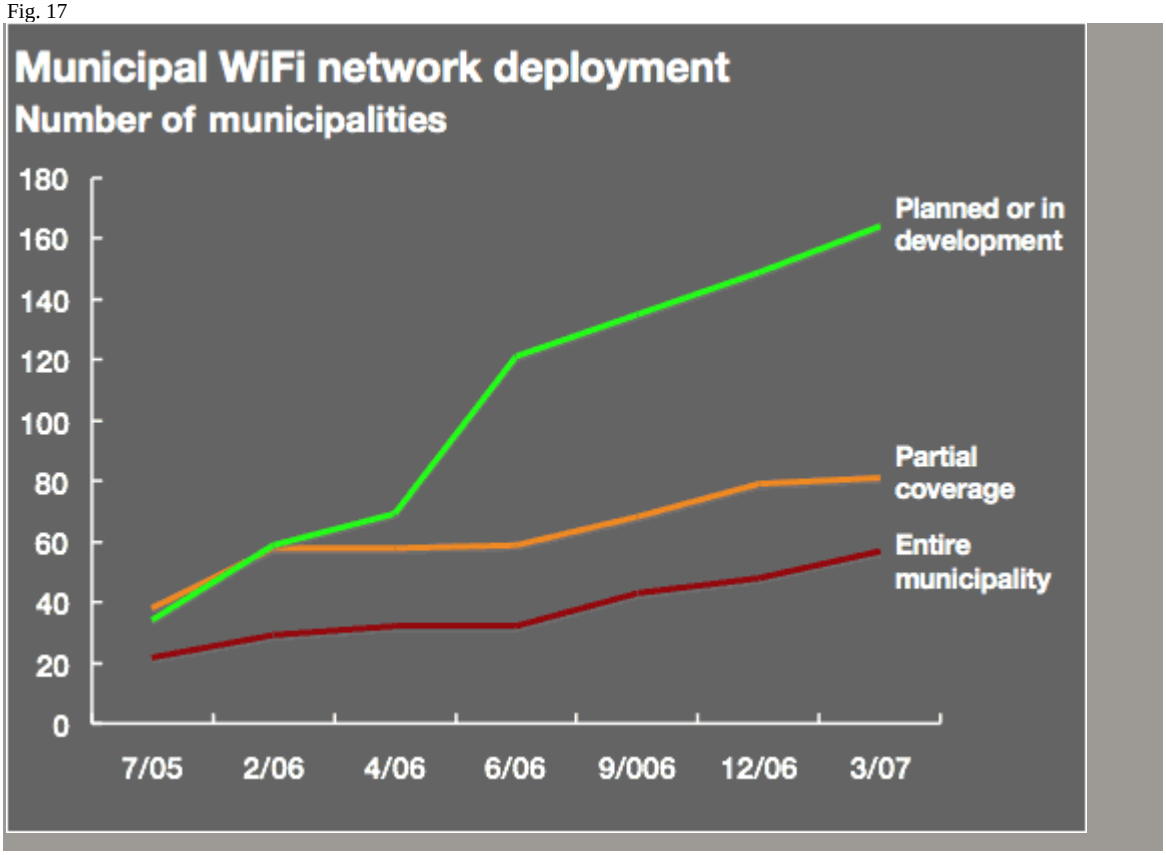
[123] Storm Jackson, *Earthlink to Build 135 Mile Philadelphia WiFi Network*, ASSOCIATED CONTENT, May 27, 2007, (http://www.associatedcontent.com/article/260298/earthlink_to_build_135_mile_philadelphia.html)

[124] *Boingo introduces worldwide Wi-Fi flat-rate plan*, CTIA SMARTBRIEF, Jun. 25, 2007. "Wi-Fi hot spot aggregator Boingo Wireless has announced what it says is the first worldwide flat-rate access plan for Wi-Fi hot spots."

Baldacci announced an initiative called Connect ME which set a goal of high-speed Internet access for 90 percent of Mainers."[125]

"The number of cities and towns where networks are either in the planning, proposal, or discussion phase has almost quadrupled since February 2006. There are currently 164 planned deployments underway, with 115 of those having moved to the construction or request for proposal (RFP) phase. Another 49 municipalities are considering WiFi networks with five of those close to issuing RFPs"[126]

Fig. 17



"The upward trend on the graph above is likely to continue. The networks are useful public services, often offering free or low-cost, ad-supported services in addition

[125] Wilson Ring, *Wireless Internet in Rural Areas is Incredible*, FREE PRESS, Jan. 2, 2007, (http://www.freepress.net/news/13127)

[126] Eric Bangeman, *Growth Spurt Continues for Munis*, ARS TECHNICA, Apr. 6, 2007, (http://origin.arstechnica.com/news.ars/post/20070406-growth-spurt-continues-for-muni-wifi-with-no-end-in-sight.html)

to paid access plans."[127] Expanded WiFi coverage is also pushing traditional cellular providers to make new offers to customers.[128]

Even though Wi-Fi is currently convenient and inexpensive,[129] development of new technologies should make broadband even faster and more accessible in the near future. One example is the 802.16e wide-area wireless network; it provides greater range and performance -- from three to 10 miles, with speeds as fast as 30Mbps -- and replaces 802.11's contention-based architecture with one based on time slicing.[130] "According to Nortel Networks CTO, John Roese, the Canadian vendor has pushed up its research spending on WiMAX from $10m to $100m over the last 12 months."[131]Although it will not likely be available until late 2007, many analysts predict that this particular version of the WiMAX standard will generate even more interest and volume—and hence economies of scale, and that WiMAX will embrace a range of profiles designed to address a wide variety of needs.[132] Later this year Sprint will "start rolling out of its $3 billion mobile WiMax network."[133] One interview indicates that Sprint is expected to have mobile WiMax coverage to 100 million customers by 2008 and between Sprint and Clearwire alone mobile WiMax coverage will reach over half the U.S. population by 2010.[134] "Boston-based Yankee Group is forecasting 28 million [WiMax] subscribers by 2011, while research firm In-Stat says Wi-Max infrastructure equipment and devices will

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[127] Eric Bangeman, *Growth Spurt Continues for Munis*, ARS TECHNICA, Apr. 6, 2007, (http://origin.arstechnica.com/news.ars/post/20070406-growth-spurt-continues-for-muni-wifi-with-no-end-in-sight.html)

[128] *See e.g.*, *Vodafone moves to counter WiFi roaming*, MOBILE@TELECOMS.COM June 29, 2007. "Vodafone has announced a new European data roaming charge for laptop users which it hopes will persuade customers to favour cellular service over wifi when overseas."

[129] *See e.g.*, JWire, Find Wi-Fi Hotspots in the United States, http://www.jiwire.com/hot-spot-directory-browse-by-state.htm?provider_id=0&country_id=1 (Last visited Jun. 6, 2007)(showing massive availability and low cost of wi-fi access). Wi-Fi access is inexpensive, as the hardware is built into just about every notebook manufactured in the past three years and a growing number of corporate offices, airports, hotels, coffee bars, and municipalities provide connectivity virtually free. Leon Erlanger, *3G v. Wi-Fi Hotspots*, INFOWORLD, Apr. 24, 2006, (http://www.infoworld.com/article/06/04/24/77293_17FE3gwimax_1.html),

[130] Leon Erlanger, *3G v. Wi-Fi Hotspots*, INFOWORLD, Apr. 24, 2006, (http://www.infoworld.com/article/06/04/24/77293_17FE3gwimax_1.html),

[131] *Nortel on WiMAX R&D spree*, TELECOMS.COM, Jul. 2, 2007 http://www.telecoms.com/itmgcontent/tcoms/news/articles/20017437714.html?1=1&mp_articleid=20017437714&mp_pubcode=MTEL&mp_channelid=30000000378&Marlinsource=V2autoMatt&ST=OEM&MarlinViewType=ARTICLEVIEW&siteid=30000000461&from=M@T-TopNews)

[132] Pierre St.-Arnaud, *Minimizing the Risks of Wi-Max Deployment*, WIRELESS TELECOM MAG., May 25, 2007, (http://www.wirtel.co.uk/article_eu_2005q1_005_srtelecom.htm)

[133] "The wide world of wimax" CNN Money.com, June 26, 2007. http://money.cnn.com/magazines/business2/business2_archive/2007/07/01/100117043/index.htm?postversion=2007062605

[134] Tim Doyle, *Q & A with Clearwire's Ben Wolff*, FORBES.COM,, Jun. 20, 2007. (http://www.forbes.com/intelligentinfrastructure/2007/06/19/clearwire-wireless-wolff-tech-infrastructure-cz_td_0620beltwayqa.html)

become a $5 billion market within four years, up from $177 million today."[135]

VI. Summary and Conclusion

The nature and history of wireline telecommunications led to notions of subscribership and universal service based on measures of connecting locations (homes and businesses). Explicit universal service funding was originally established in the U.S. as a wireline concept; wireless providers were virtually precluded from obtaining universal service funding. This contributed to a bias against wireless providers and a distortion in the technology choices by providers, even though wireless technology has characteristics that are likely to make it the lower cost technology in some rural areas (at some level of market penetration).

Today, customer's concepts of connection to the network have shifted from connection to locations to connection to customers themselves. Customers now demand access across time and space. Several factors indicate the importance of wireless service to customer's concepts of access to a modern network: growth in wireless and flattening or decline in wireline penetration; growth in wireless usage and declines in wireline usage; substitution of wireless for wireline access and usage; declining wireless prices and rising local wireline prices; growth in broadband services and mobile data connectivity; growth in dual mode phones and the potential for rapid deployment of femtocell technology; and wireless service characteristics that are of value to customers.

In keeping with this shift in paradigm, universal service is no longer predicated on network connections via wireline facilities. Over the last few years, state commissions and the FCC have increasingly recognized that the public interest is served by wireless services becoming eligible for universal service funding.[136]

Sound universal service policy (like sound public policy in general) must be competitively neutral. That is, it must be neutral with respect to technology, and with respect to firms. The ultimate public policy mistake is to abandon the fundamental principle of competitive neutrality and pervert market results in order to achieve a politically expeditious result. Caps specific to CETC or wireless technologies, or selective applications of policy changes by technology (e.g., the application of a reverse auction to wireless providers but not wireline) are obviously not competitively neutral. If pursued by private interests, such behavior would not pass muster under the antitrust laws of the United States (nor of many other countries).

Moreover, without competitive neutrality, consumer choice and sovereignty is subverted. In a recent consumer poll commissioned by MyWireless.org®, 70% of consumers said they support "using a *greater* portion of the universal service funding to help cell phone companies improve the quality of cell phone service in rural and high-

[135] Michal Lev-Ram, *The Wide World of Wi-max*, CNN Money.com, Jun. 26, 2007. (http://money.cnn.com/magazines/business2/business2_archive/2007/07/01/100117043/index.htm?postversion=2007062605)

[136] *See* Competition in Rural America: The Experiences of Competitive Eligible Telecommunications Carriers Entering the Local Telephone Market, filed in FCC Docket 96-45 on May 5, 2003.

cost areas"; only 16% of consumers said they oppose such a proposal.[137] Without competitive neutrality, the path forward will reflect the political/regulatory perception of universal service, not the changing expectations of connectivity of Americans.

[137] MyWireless.org, 2007 National Customer Survey, http://www.mywireless.org/nationalsurvey/ (last visited Jun. 29, 2007).